
**Base Realignment and Closure**
**Program Management Office West**
**1230 Columbia Street, Suite 1100**
**San Diego, California 92101**

# FINAL

# RADIOLOGICAL SUPPORT WORK PLAN INSTALLATION RESTORATION SITE 32 ACTIVITIES

**Revision 0**
**September 29, 2005**

**ALAMEDA POINT**
**ALAMEDA, CALIFORNIA**

Base Realignment and Closure
Program Management Office West
1230 Columbia Street, Suite 1100
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CONTRACT NO. N68711-98-D-5713
CTO NO. 0087

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**Revision 0**
**September 29, 2005**

**ALAMEDA POINT**
**ALAMEDA, CALIFORNIA**

**DCN: FWSD-RAC-05-1808**


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## APPENDICES

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| µrem/hr | microrem per hour |
| α | alpha |
| β | beta |
| γ | gamma |
| AEC | Atomic Energy Commission |
| ALI | annual limit of intake |
| BEI | Bechtel Environmental, Inc. |
| CEDE | committed effective dose equivalent |
| CFR | Code of Federal Regulations |
| $cm^2$ | square centimeters |
| DAC | derived air concentration |
| DOE | Department of Energy |
| dpm | disintegrations per minute |
| ICRP | International Commission on Radiological Protection |
| IR | Installation Restoration |
| $m^2$ | square meter |
| NaI | sodium iodide |
| NAVFAC SW | Naval Facilities Engineering Command, Southwest |
| NRC | Nuclear Regulatory Commission |
| RAC | Remedial Action Contract |
| RCT | Radiological Control Technician |
| RI | Remedial Investigation |
| SAP | Sampling and Analysis Plan |
| SOP | Standard Operating Procedure |
| $^{90}Sr$ | strontium 90 |
| TtEC | Tetra Tech EC, Inc. |
| TtFW | Tetra Tech FW, Inc. |

# 1.0 INTRODUCTION

This Radiological Support Work Plan describes the specific activities pertaining to the radiological support of Installation Restoration (IR) Site 32 Remedial Investigation (RI) activities being performed by Bechtel Environmental, Inc. (BEI). The Base Realignment and Closure Program Management Office West has authorized Tetra Tech EC, Inc. (TtEC) to perform the subject radiological support under Contract Task Order No. 0087 through the contracting mechanism of Naval Facilities Engineering Command, Southwest (NAVFAC SW), Remedial Action Contract (RAC) N68711-98-D-5713.

The objective of the new work is to radiologically survey the proposed sampling locations, the sampling equipment, and soil removed during the IR Site 32 RI activities being performed by BEI. IR Site 32 is not considered a radiologically impacted site; however, during the initial work performed by BEI there was uncertainty if elevated beta activity was encountered. To ensure that proper radiological controls are in place, in the event that radiological contamination is encountered, TtEC has been contracted by the Navy to support BEI IR Site 32 field activities by providing radiological screening of equipment and soil during the planned field activities and to perform clearance surveys on any equipment for free release if radiological contamination is observed.

In addition to providing radiological survey support, up to 15 soil samples may be collected and sent to an off-site laboratory for radionuclide characterization. Soil samples will be collected at biased locations if radiological contamination is observed to determine the radionuclide(s) of concern. If no radiological contamination is found, then samples for radiological analysis will not be collected.

# 2.0 PLANNED ACTIVITIES

This section will briefly describe the specific field activities involved in the planned radiological support. The radiological support activities will include establishing a background gamma count rate for the sodium iodide (NaI) detector, provide radiation technician support (Radiological control Technician [RCT]) to the BEI field team, and release equipment and material from the site once the field activities are completed.

## 2.1 BACKGROUND DETERMINATION

The ambient gamma background will be established for the NaI detector, and the ambient dose rate will be established for the MicroRem meter. The standard deviation of these fixed readings in the background areas will be used for determining the investigation criterion of 3 sigma above background. This will be accomplished by summing the measurements from all three background areas and calculating the average and standard deviation of the measurements.

Nine static background measurements and one field duplicate from each reference area identified in the IR Site 1 Radiological Survey Work Plan (Tetra Tech FW, Inc. [TtFW], 2004) will be obtained to establish the average background count rate for the NaI detector and dose rate for the MicroRem meter. Five 1-minute stationary readings will be taken at a distance of 3 inches above the ground at each of the locations within a reference area using a 2-inch by 2-inch NaI detector coupled to an E-600 probe. The average of the NaI readings will be recorded for each sample location. In addition, the exposure rate will be obtained at 3 feet (waist high) above the ground at each of the 10 locations within a reference area using an Eberline MicroRem meter.

## 2.2 RADIOLOGICAL SCREENING

The RCT will perform both contamination and dose rate surveys during site investigation activities. Surveys will be performed in accordance with Alameda Point Project Standard Operating Procedure (SOP) ALAM-Tt-006, *Radiation and Contamination Surveys*.

Both personnel and equipment will be periodically surveyed to ensure that any contamination encountered is promptly identified. In addition, area dose rate measurements will be periodically performed to ensure that any changes in site dose rate will be promptly identified.

Contamination surveys will be performed using the SHP380AB connected to an Eberline E-600. For equipment, these surveys will consist of periodically frisking the surface of the sampling equipment that have come in contact with the soil during field activities. Surveys for removable contamination will be performed by taking a large-area wipe of the surfaces that have come in contact with the soil during field activities. Contamination surveys of personnel will consist of periodically performing hand and foot surveys of the field crew during field activities.

Dose rate surveys will be performed using the Eberline MicroRem meter and will consist of waist-high measurements in the work area.

The frequency of the contamination and dose rate surveys will be based on the radiological conditions observed at the sample location. If no radiological contamination is observed, then minimal surveys will be required. At a minimum, the equipment will be surveyed before being relocated to a new sample location. If radiological contamination is found on the equipment, then the item(s) will be wiped down to remove the contamination and resurveyed until they are free of observable contamination. In addition, the RCT will perform a hand and foot survey on each member of the field crew working at the sample location.

If radiological contamination is observed at the sample location during field activities, the RCT will establish the frequency of surveys such that the potential for loss of contamination control is minimized by periodically surveying the sampling equipment and soil removed from the boring during soil sampling activities. Prior to moving to the next sample location, the equipment that has come in contact with potentially contaminated soil will be surveyed. In addition, the RCT will perform a hand and foot survey on each member of the field crew working at the sample location.

At each location where soil sampling is to be performed, the RCT will perform a surface scan of the proposed sampling location to identify any elevated activity before the sampling begins. The surface scan will be performed using the NaI detector attached to the Eberline E-600 and the SHP380AB. If radiological contamination is found, a surface soil sample will be collected and a different sampling location nearby that does not indicate the presence of radiological contamination will be selected for subsurface sampling.

## 2.3 MATERIAL AND EQUIPMENT RELEASE

A radiological release survey will be performed on equipment used inside the IR Site 32 controlled area during the RI to verify that radiological release limits are not exceeded. The controlled area is the area within IR Site 32 that BEI controls for health and safety purposes during the field activities.

Prior to relocating equipment from one sample location, the next the equipment will be surveyed using the SHP380AB for alpha/beta activity. Large-area wipes will be used to determine if there is removable contamination present. If contamination is found on the equipment, the equipment will be wiped down to remove the contamination and then resurveyed. Equipment and material that required decontamination prior to moving to the next sampling location, or released from the site, will be decontaminated in accordance with the Alameda Point Project SOP ALAM-Tt-016, *Decontamination of Equipment and Tools*, which is provided in Appendix A.

At the end of field activities when the equipment is to be released from control of the site, an unconditional release survey will be performed on the equipment that came into contact with any radiologically contaminated soil. This survey will consist of both fixed and removable contamination surveys. The fixed contamination surveys will be performed by scanning 100 percent of the accessible surfaces of the equipment that came into contact with any radiologically contaminated soil using the SHP380AB detector. The contamination surveys will be performed by collecting 100-square centimeter ($cm^2$) swipes from the equipment surfaces that came into contact with radiologically contaminated soil and counting the swipes on a low-background alpha/beta counter.

The amount of removable radioactive material per 100 $cm^2$ of surface area will be determined by wiping the area with a dry filter or soft absorbent paper and evaluating the wipe for alpha and beta-gamma activity using a low-background scaler. The following levels apply to the release of equipment and material:

| Radiation Type | Release Limits[1] (Fixed) (disintegrations per minute [dpm] per 100 $cm^2$) | Release Limits[1] (Removable) (dpm per 100 $cm^2$) |
|---|---|---|
| Alpha ($\alpha$) | 100 | 20 |
| Beta ($\beta$-) | 1000 | 200 |
| Gamma ($\gamma$) | 5,000 | 1,000 |

***Notes:***
[1] These limits based on AEC Regultory Guide 1.86 (AEC, 1974)
AEC – Atomic Energy Commission
$cm^2$ – square centimeters
dpm – disintegrations per minute

Alameda Point Project SOP ALAM-Tt-012, *Release of Materials and Equipment from Radiologically Controlled Areas,* which will be followed for the unconditional release of equipment, is provided in Appendix A.

## 2.4 SOIL SAMPLING

If radiological contamination is encountered during field activities, up to 15 soil samples will be collected from IR Site 32 for gamma spectroscopy analysis to identify the radionuclides that are contributing to the elevated ambient gamma dose rate. Of the 15 soil samples, five will also have strontium 90 ($^{90}Sr$) analysis performed. The five samples selected for $^{90}Sr$ analysis will be selected on a biased basis such that the five samples with the greatest elevated beta/gamma activity or elevated beta activity without associated elevated gamma activity will be analyzed for $^{90}Sr$.

A soil sample will be collected from each location where elevated radiological readings (3 sigma above background levels) are encountered. Soil sampling activities will be carefully controlled,

with personnel, at a minimum, wearing gloves while collecting samples. Samples will be surveyed before they are removed from the area to ensure that the radiation levels of the sample are acceptable to permit release. The samples will be collected and controlled as described by the Alameda Point Project SOP ALAM-Tt-009, *Sampling Procedures for Radiological Surveys,* provided in Appendix A and the Sampling and Analysis Plan (SAP) provided in Appendix B. Release limits are discussed in Section 3.4.4.

# 3.0 RADIOLOGICAL HEALTH AND SAFETY REQUIREMENTS

Radiological control protocols will be implemented to support the planned RI field activities at IR Site 32. These protocols are intended to protect the health and safety of workers and the general public and to minimize the liability to the Navy for risks associated with radioactive materials.

## 3.1 AIR SAMPLING PROGRAM

Based on the known radiological condition at IR Site 32, the radionuclide of concern is radium-226, which is not expected to be present in releasable form during the planned field activities when airborne concentrations would exceed 10 percent of the derived air concentration (DAC) for radium-226. Therefore, workplace air monitoring will not be required. However, to err on the conservative side, personnel air sampling will be performed using lapel® air samplers to measure the airborne concentration in the breathing zone air of the workers. The lapel air monitoring will be conducted following standard industrial hygiene methods. A known amount of air will be collected in the "breathing zone" on an air filter in an "open face" cassette. Air filters will be collected daily and counted on the low-background scaler. Air filters that are assigned a net count rate above the background count rate for alpha radiation will be segregated and recounted after 72 hours (e.g., 3 days). The 72-hour recount will be performed to determine if the activity recorded was from radon daughters or from uranium.

If personnel air sampling, after correcting for radon daughters, indicates a potential radium intake greater than 0.02 annual limit of intake (ALI), a spot urine sample will be collected from the worker and sent off site for analysis to confirm the intake. A stop work order will be issued while the potential causes are evaluated and the Navy (Radiological Affairs Support Office [RASO]) is notified of the potential intake.

## 3.2 RESPIRATORY PROTECTION PROGRAM (IF REQUIRED)

Given the conditions at IR Site 32 and the planned work activities to be performed, respiratory protection is not expected to be required. If it is determined that respiratory program discussed in Section 13 of the BEI plan will be followed (Bechtel National, Inc., 1997).

## 3.3 PERSONNEL EXPOSURE MONITORING

Dose rates at IR Site 32 are expected to be below the Nuclear Regulatory Commission (NRC) unrestricted area dose rate of 0.002 rem per hour. Inasmuch as the site dose rate is below 0.002 rem per hour, it is not likely that workers will receive a dose in excess of 0.5 rem. Therefore, occupational exposure monitoring will not be required in accordance with 10 Code of Federal

Regulations (CFR) 20.1502. Dose rates at IR Site 32 will be periodically collected during the survey to verify that personnel exposure monitoring is not required.

### 3.3.1 External Exposure Determination (If Required)

Dose rates at IR Site 32 are expected to be below the NRC unrestricted area dose rate of 0.002 rem per hour. Inasmuch as the site dose rate is below 0.002 rem per hour, it is not likely that workers will receive a dose in excess of 0.1 rem. Therefore, occupational exposure monitoring is not required in accordance with 10 CFR 20.1502. Dose rates at IR Site 32 will be periodically measured during field activities to verify that personnel exposure monitoring is not required.

### 3.3.2 Internal Exposure Determination (If Required)

Given the conditions at IR Site 32, it is not expected that workers will receive an internal exposure greater than 10 percent of the ALI. Therefore, internal dosimetry evaluations will not be performed.

Internal dosimetry investigations will be performed with possible follow-up bioassay sampling when:

- Face or nasal contamination is observed
- Personnel air sampling indicates that a worker(s) may have received an inhalation exposure in excess of 0.02 ALI
- Other reasons as determined by the RCT

An internal dosimetry investigation will include the following actions:

- A preliminary internal dose estimate based on air sampling and/or bioassay results.
- An interview with the worker, their supervisor, and/or involved RCTs to determine radiological working conditions and potential time of intake.
- Issuance of a radiological work restriction, if preliminary dose estimates are greater than or equal to 100 mrem of the committed effective dose equivalent to limit any further exposure that may prevent obtaining valid follow-up bioassay sampling and interfere with the dose evaluation.
- Follow-up bioassay sampling (in-vitro and/or in-vivo) to confirm initial results.
- Notification of the worker and supervisor after follow-up sampling is completed and the final dose estimate completed.

The radiation dose equivalent incurred from internally deposited radionuclides will be estimated using widely accepted methods. Currently, bioassay methods accepted by the NRC and the Department of Energy (DOE) are those proposed by the International Commission on Radiological Protection (ICRP Publication 30). At a minimum, such assessments will include:

- Chemical and physical form of the radionuclides
- Bioassay results and previous exposure history
- Route of intake and time and duration of exposure
- Biological models used for dosimetry
- Models to estimate intake or deposition and to assess dose
- Any recommended medical intervention

### 3.3.3 Summation of Internal and External Exposures

Based on the conditions at IR Site 32, it is not expected that workers will receive a recordable exposures from either internal or external sources of radiation. However, if workers do receive a recordable exposure, the requirements of 10 CFR 20.1202 will be followed to comply with the requirements for summation of external and internal doses received.

## 3.4 CONTAMINATION CONTROL PROGRAM

Radiological control procedures will be implemented during the planned field activities at IR Site 32. These practices are intended to protect the health and safety of workers and general public.

### 3.4.1 Periodic Monitoring

The RCT will perform periodic contamination and dose rate surveys during work activities to ensure that project personnel are aware of any changes to the site radiological conditions.

### 3.4.2 Personnel Survey Procedure

Personnel exiting the controlled area of IR Site 32 will undergo a personnel survey prior to exiting the controlled area if during the field activities, elevated radiological readings were observed. If elevated radiological readings were not observed, then a hand and foot survey will only be required.

If a worker finds contamination while surveying outside of the controlled area, they are to stop and notify the RCT. The potentially contaminated worker will stay at the controlled area entrance to minimize potentially spreading contamination. The RCT will assist the worker in decontaminating the affected areas using standard decontamination techniques. A stop work order will be issued while the potential causes are evaluated and the Navy (RASO) is notified of the personnel contamination. Personnel surveys and decontamination will be performed in accordance with Alameda Point Project SOP ALAM-Tt-022, *Radiological Protective Clothing Selection, Monitoring, and Decontamination*, which is provided in Appendix A.

### 3.4.3 Equipment Surveys

Equipment exiting the controlled area of IR Site 32, but not being released from IR Site 32, will undergo a fixed and removable survey prior to exiting the controlled area if during the field activities, the equipment encountered elevated radiological readings. The fixed survey will consist of the scan of 100 percent of the accessible areas of the equipment that came into contact with radiologically contaminated soil using the SHP380AB. The removable contamination surveys will be performed by taking large-area wipes of the accessible surface of the equipment that came into contact with radiologically contaminated soil. If removable contamination is found, the equipment will be wiped down and resurveyed to verify that the contamination has been removed. If elevated radiological readings were not observed during the field activities, then the RCT will use their judgment as to what equipment should be surveyed and the frequency of surveys.

### 3.4.4 Unconditional Release Surveys

An unconditional release survey will be preformed on equipment used inside the IR Site 32 controlled area during the radiological survey prior to final release of the equipment from the site to verify that radiological release limits are not exceeded. This survey will consist of the scan of 100 percent of the accessible areas of the equipment that came into contact with radiologically contaminated soil using the SHP380AB. The removable contamination surveys will be performed by collecting 100-$cm^2$ swipes of the accessible surface of the equipment that came into contact with radiologically contaminated soil.

The amount of removable radioactive material per 100 $cm^2$ of surface area will be determined by wiping the area with dry filter or soft absorbent paper and evaluating the wipe for alpha and beta-gamma activity using the sample in a low-background scaler.

Alameda Point Project SOP ALAM-Tt-012, *Release of Materials and Equipment from Radiologically Controlled Areas,* which will be followed for the unconditional release of equipment, is provided in Appendix A.

## 3.5 SURVEY INSTRUMENTATION

Both portable and bench-top radiation monitoring equipment will be used to monitor the radiological condition at the site during work activities. Instruments will be operated in accordance with manufacturer's recommendations and Alameda Point Project SOP ALAM-Tt-007, *Preparation of Portable Radiation and Contamination Survey Meters and Instruments for Field Work,* which is provided in Appendix A.

### 3.5.1 Instrument for Alpha/Beta Surveys

Surveys for alpha/beta radiation will be performed using an Eberline E-600 with a SHP380AB scintillator probe. The instrument measures alpha and beta radiation levels and presents data in a digital display. Static measurements for particulate radiations are instantaneously recorded by the rate meter after positioning the detector, a scintillation probe, directly over a designated surveillance surface.

### 3.5.2 Instrument for Gamma Surveys

Surveys for gamma (photon) radiation will be performed using an Eberline E-600 using a 2-inch by 2-inch NaI crystal. The instrument is programmed to respond to the full spectrum of gamma photon energies since it is capable of detecting gamma photon energies ranging from 60 kiloelectron volts to 3 megaelectron volts. These measurements are always made with the instrument audio "on" to facilitate rapid detection of changes in instrument count rate. NaI scintillation detectors are very sensitive to gamma radiation and are ideal for locating elevated radiation levels above background.

### 3.5.3 Instrument for Exposure Rate Surveys

Exposure rate surveys will be performed when it is desired to measure the ambient exposure rate at a given location on the site. Exposure rate surveys, obtained approximately 1 meter from contact with area surfaces, will be conducted using an Eberline MicroRem meter. Compatible with anticipated exposure rates, the instrument is equipped with an internally mounted tissue equivalent organic scintillator detector. The MicroRem meter provides optimum performance in measuring low-level gamma photon radiation readings, which are readily provided on the meter face in units of microrem per hour (μrem/hr).

### 3.5.4 Instrument Calibration and Efficiency

TtEC will use the services of a radiological instrumentation supplier for the radiological instruments and check sources used during the survey. The equipment supplier is required to provide calibration documentation for each radiological instrument supplied.

The supplier will perform the necessary calibration of their radiological instrumentation annually. The instruments will not be accepted from the supplier, unless they have been calibrated prior to shipment to TtEC. The supplier will include certificates of calibration and calibration data with each instrument. TtEC will not perform calibrations in the field for these instruments; therefore, the SOPs for the calibration of these instruments are not being provided. Operational checks will be performed daily to verify that the instruments are functioning properly. *These checks are discussed in Section 3.5.5.*

### 3.5.5 Instrument Operational Checks

Prior to use of the radiological instruments, calibration verification, physical inspection, battery check, and source response check will be performed. All portable radiological instruments will have a current calibration label. Calibration verification will be performed daily prior to use of the instrument.

Physical inspection of the instrument will include:

- Inspect the general physical condition of the instrument and detector prior to each use.
- Inspect for loose, damaged knobs, buttons, cables, connectors, broken/damaged meter movements/displays, dented or corroded instrument cases, punctured/deformed probe/probe window(s), cables, and any other physical impairments that may affect the proper operation of the instrument or detector.

Any instrument or detector having a questionable physical condition will not be used until corrected.

A battery check will be performed to ensure that there is sufficient voltage being supplied to the detector and instrument circuitry for proper operation. This check will be performed in accordance with the instrument's operations manual; although, it is generally performed as follows:

- Position the appropriate selector switch to the "Batt" position or depress the "Batt Check" button with the instrument on.
- Observe the indication for the current battery condition. Typically, the current battery condition will be indicated by a meter deflection into the "Batt OK" region or "Batt OK" on the display.

If unsatisfactory results are obtained, refer to the operations manual for replacement of the batteries and repeat the check. The instrument should display a satisfactory battery check prior to use.

Upon receipt of the instruments, a response check range will be established. On a daily basis, the instrument will be exposed to the check source to verify that the instrument response is within the +/- 20 percent range determined during the initial response check.

The results of the daily operation checks discussed above will be entered into the field logbook. Instruments that do not pass the daily operation checks will be removed from service and returned to the supplier for maintenance.

# 4.0 WASTE MANAGEMENT REQUIREMENTS

The proposed work will generate only used personal protection equipment waste for off-site disposal.

As crewmembers egress from the work areas on a daily basis, they will remove their rubber totes and secure them in a 55-gallon drum for either reuse or disposal. The RCT will survey the totes and frisk the crewmembers using the SHP380AB detector. At the completion of the work activities, the non-contaminated totes and any non-radiologically contaminated investigation-derived waste will be disposed as non-hazardous waste at a TtEC-approved Class II landfill. In the event that radiologically contaminated investigation-derived waste is generated (i.e., contaminated totes), the waste will be segregated from non-radiologically impacted waste and TtEC will contact the Naval Sea System Command Detachment, RASO, the Project Health Physicist, and the Project Manager for the purpose of determining the disposition of the contaminated totes.

# 5.0 REFERENCES

Bechtel National, Inc. 1997. *Program Safety and Health Plan, Navy CLEAN, Revision 2, San Diego, California.*

International Commission on Radiological Protection (ICRP Publication 30). 1979. *Limits for Intakes of Radionuclides by Workers.*

Tetra Tech FW, Inc. (TtFW). 2004. *Final Installation Restoration Site 1 Radiological Survey Work Plan, Alameda Point, Alameda, California.* June.

# APPENDIX A

# STANDARD OPERATING PROCEDURES

# ALAMEDA POINT PROJECT

## Standard Operating Procedure

## RADIATION AND CONTAMINATION SURVEYS

### ALAM-Tt-006

### Revision 0

Approved By:

| | |
|---|---|
| Project Health Physicst | Date |
| Project Manager | Date |

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## 1.0 PURPOSE

The purpose of this procedure is to specify methods and requirements for radiological surveys and documentation of acquired data.

Adherence to this procedure will provide reasonable assurance that the surveys performed have reproducible results. This guidance for control of radiation exposures provided in this procedure is in accordance with the as low as reasonably achievable (ALARA) philosophy.

## 2.0 SCOPE

This procedure shall be implemented by Tetra Tech EC, Inc. (TtEC) staff and subcontractor personnel when conducting radiation or contamination surveys.

## 3.0 DEFINITIONS AND ABBREVIATIONS

**Activity** - The rate of disintegration (transformation) or decay of radioactive material. The units of activity for the purpose of this procedure are disintegrations per minute (dpm) for loose and fixed surface contamination, picocuries per gram (pCi/g) for soil, or microcuries per milliliter (μCi/mL) for airborne contamination.

**Contamination** - Deposition of radioactive material in any place it is not desired. Contamination may be due to the presence of alpha particle, beta particle or gamma ray emitting radionuclides.

**Controlled Area** - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or to prevent the release of radioactive materials to the uncontrolled areas.

**Exposure Rate** - The amount of radiation (exposure) delivered at a given point per unit time. Typical units are microroentgen per hour (μR/hr).

**Fixed Contamination** - Radioactive contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk swipe, or masslin.

**Minimum Detectable Activity (MDA)** - For purposes of this procedure, MDA for removable radioactive contamination is defined as the smallest amount of sample activity that will yield a net count with a 95 percent confidence level based upon the background count rate of the laboratory counting instrument used.

**Minimum Detectable Concentration (MDC)** - For purposes of this procedure, MDC is the *a priori* activity level that a specific instrument and technique can be expected to detect 95 percent of the time for portable survey instruments.

**Removable Surface Contamination** - Radioactive contamination that is readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk swipe, or masslin.

**Uncontrolled Area** - An uncontrolled area is any area where access is not controlled for radiological purposes.

# 4.0 PROCEDURE DETAILS

## 4.1 GENERAL

Radiation surveys are performed to identify radiation areas, measure the exposure rate, and assess the intensity and shape of those areas to determine control requirements at the worksite.

Contamination surveys are conducted to detect loose surface contamination and fixed contamination. Loose surface contamination is normally detected indirectly by a swipe sample or wipe performed on the item or surface of interest. Fixed contamination levels are measured directly.

Survey results, locations, and any unusual conditions shall be documented and described on Attachments 1 and 2, Radiation/Contamination Survey Form and Radiation/Contamination Survey Supplement, respectively.

When performing surveys, express readings as the actual observed number. Do not report "<MDA" or "<Bkg". When background corrections are made, results may be expressed as negative numbers as applicable.

### 4.1.1 DISCUSSION

Radiation and contamination surveys shall be performed on an as-needed basis. The need for performing a survey is identified by, but not limited to the following conditions:

- A condition exists where radiological data are needed.
- An investigation is required due to abnormal conditions or indications.
- An ongoing job requires a survey to update radiological postings.
- As required to support *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM; NUREG-1575) based survey activities.

### 4.1.2 PLANNING AND PREREQUISITES

Instruments used to perform radiation and contamination surveys shall be operated in accordance with their operation procedure. Steps to be completed during the planning phase include the following:

- Obtain appropriate survey instruments and prepare the instruments for use.

- Obtain the necessary forms, swipes, and applicable protective clothing that will be used during the survey.

Prior to entering an area to perform a survey, each radiation detection instrument shall be:

- Battery checked.
- Checked for obvious physical damage.
- Quantitatively response-checked daily, prior to use.
- Checked to ensure that the instrument calibration is current.

If any of the above conditions are unsatisfactory, the instrument shall be tagged out of service and not used.

## 4.2 PROCEDURE PROCESS

### 4.2.1 EXPOSURE SURVEYS

Always survey a sufficient number of locations to determine average and maximum general area and contact radiation levels.

A Ludlum Model-19 or equivalent should be used for performing exposure rate surveys for gamma radiation. The instrument should be operated in accordance with the manufacturer-supplied operations manual and any applicable requirements from work-specific documents. Care should be taken to ensure that the instrument has been allowed to stabilize between individual measurements.

When performing general area exposure rate surveys, the Radiological control Technician (RCT) should:

- Attempt to determine the source of radiation fields.
- Record the highest level as the general area exposure rate.
- Perform contact exposure rate measurements with the detector within 1 inch of the surface to be surveyed.
- Perform surveys at approximately 1 meter (waist level) from surface to establish posting requirements for the area.
- Verify the exposure rates of known hot spots.

### 4.2.2 REMOVABLE CONTAMINATION SURVEYS

#### 4.2.2.1 Removable Contamination Swipe

The following guidance shall be used unless an approved site-specific survey/work instruction directs otherwise.

4.2.2.2 Swipe Surveys

1. Label or number swipes, as necessary, to identify each swipe.
2. Wipe the swipes over approximately 100 square centimeters ($cm^2$) (16 square inches) of the surface to be sampled.
3. Apply moderate pressure.
4. Exercise care on rough surfaces so as not to tear the swipes.
5. Exercise care on wet surfaces so as not to degrade the swipes. Ensure that surfaces are not submerged in water and that cloth swipes or similar are used on wet/damp surfaces.

When surveying an area:

1. Obtain swipes from sample points, which are representative of the average and maximum contamination levels in the area, as identified during preliminary surveys. These areas could include:
    a. Areas of high traffic
    b. On and under benches or tables
    c. Beneath piping and components
    d. On accessible wall surfaces
    e. On piping and significant components
    f. Near drains, sumps and low spots
2. Swipe floor and component surfaces, which display evidence of (potentially) contaminated water leakage.
3. Ensure contamination is not spread to clean areas when obtaining swipes.

When surveying equipment:

1. Obtain swipes on large surfaces.
2. Obtain swipes in cracks or crevices where contamination may have settled.
3. Obtain swipes on openings to internal surfaces.
4. Handle swipes in a manner that will prevent cross-contamination such as by placing each swipe in a separate envelope.

4.2.2.3 Counting Swipes

Low-background gas-proportional counters should be used whenever practical. Typically a Protean IPC 9025 and/or a Tennelec Series 5 XLB gas-flow-proportional alpha/beta radiation counter will be employed to count swipes. As a backup to the gas-flow-proportional counters a Ludlum Model 2929 scaler with a Model 43-10-1 ZnS(Ag) scintillation probe (or equivalent) may be used.

1. Count the swipes in accordance with the operating procedure for the instrument.
2. Record swipe results in dpm/100 cm².
3. Store/archive used swipes as radioactive material until disposal is approved by the Radiological Affairs Support Office (RASO).

#### 4.2.2.4 Removable Contamination Surveys Using Large-area Wipes (LAWs)

Large-area contamination surveys using LAWs are appropriate for monitoring the radiological cleanliness of non-contaminated areas or equipment, to track area decontamination progress, or for initially verifying that surfaces are free from contamination.

There are no specific requirements concerning the amount of area to be wiped when performing LAWs. The area wiped should be determined based on the use of the survey data and the dust loading of the LAW material.

#### 4.2.2.5 Performing LAWs

Use masslin, oil-impregnated cloths, or equivalent media to perform LAWs. Select an appropriate collection material and method based upon the survey conditions such as wet surfaces, rough surfaces, heavily soiled area and oily and greasy surfaces.

1. Label or number the cloths, as necessary, to assist in determining the location of the sample.
2. Determine the size of the area to be sampled based on the results of the survey.
3. Wipe the collection media over the surface using moderate pressure by hand, with a masslin mop, or other approved techniques.

#### 4.2.2.6 Evaluating LAWs

1. Allow wet swipe to dry prior to counting.
2. Scan the swipe with an appropriate field instrument (2360/43-89, or equivalent), in an area with a low background.
3. Hold the detector within ½ inch of the swipe and move the detector over the swipe at a maximum rate of 1 inch per second.
4. If any indication of an increased count rate is noted, pause to allow the meter reading to stabilize.
5. If the swipe reading is indistinguishable from background, consider the surveyed surface to be free from contamination. If the LAW reading is greater, conduct further surveys to isolate the boundaries of the contamination.
6. Dispose of used LAW media as radioactive waste.

### 4.2.3 SURVEYS FOR FIXED ALPHA/BETA CONTAMINATION

Fixed contamination surveys are used to obtain indications of fixed contamination levels on surface areas, pieces of equipment, or tools for characterization and/or release surveys. Fixed contamination surveys are also performed to assess if residual contamination is present greater than the release criteria for the radionuclide(s) of concern.

A Ludlum Model-2360/43-68 or equivalent should be used for performing fixed contamination surveys for alpha and beta radiation.

#### 4.2.3.1 Scans

1. When surveying for fixed alpha/beta contamination, the probe should be held within 1/4 inch or less from the surface being surveyed. The movement rate of the detector probe should be 1 inch per second or slower.
2. When performing direct scan surveys of objects, surfaces, materials, equipment, etc., static measurements should be performed frequently to ensure the detection of residual activity.
3. Whenever practical, 100 percent of accessible areas being surveyed should be direct-scan surveyed, unless the applicable work planning document indicates otherwise.
4. Scan ranges are documented as the range from the lowest measurement to the highest measurement observed.

#### 4.2.3.2 Static

1. Count time for conducting static measurements will be dependent upon the isotope of concern and the MDA for the instrument being used.
2. Static measurements should be performed as required by a work-specific document or frequently enough to ensure the detection of residual activity.
3. When taking a static measurement for fixed alpha/beta contamination, the probe should be held within 1/4 inch or less from the surface being surveyed.
4. Results should be reported in units of net counts per minute (cpm) above background or dpm/100 $cm^2$.

The following formula should be used for converting direct probe readings in cpm to dpm/100 $cm^2$:

$$A_S = \frac{R_{S+B} - R_B}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

where,

$A_S$ = total surface activity (dpm/100 $cm^2$)
$R_{S+B}$ = the gross count rate of the measurement in cpm
$R_B$ = the background count rate in cpm
$\varepsilon_i$ = the instrument efficiency (counts per particle)
$\varepsilon_s$ = the contaminated surface efficiency (particles per disintegration)
$W_A$ = the physical area of the detector window ($cm^2$)

In the absence of experimentally determined surface efficiencies, ISO-7503-1 and NUREG-1507, provide conservative recommendations for surface efficiencies. ISO-7503-1, recommends a surface efficiency of 0.25 for alpha emitters. NUREG-1507 provides surface efficiencies based on studies performed primarily at Oak Ridge Institute for Science and Education (ORISE). A surface efficiency of 0.25 will be used for alpha/beta emitters.

### 4.2.4 GAMMA SURVEYS

A Ludlum Model-2350-1/44-10 or equivalent should be used for gamma radiation surveys.

A single detector or an array of detectors may be used to perform gamma scans.

#### 4.2.4.1 Scans

1. Set the audio response switch to the "on" position.
2. If a single detector is used, traverse a path at a maximum speed of approximately 0.5 meters per second and slowly move the detector assembly in a serpentine (S-shaped) pattern, while maintaining the detector approximately 10 centimeters (cm) (4 inches) from the area being surveyed.
3. If a detector array is used, it will be pushed or pulled in a straight line with the detector centers positioned approximately 30 cm apart.
4. Scan ranges should be recorded from the lowest reading to the highest reading noted.
5. If data logging is being performed, the scan data will be collected at the time interval necessary to obtain the measurements required for the survey.
6. Locations of radiation levels greater than 3 standard deviations above background shall be marked and identified for further investigations.
7. Measurement results are recorded in cpm.

4.2.4.2 Static

1. Static photon measurements require positioning the detector assembly approximately 10 cm (4 inches) above the surface and completing a stationary 60-second survey.
2. Static measurements should be performed as required in the applicable work planning document or frequently enough to ensure the detection of residual activity.
3. Record results in cpm.

## 5.0 RECORDS

Radiation/Contamination Survey Form

Radiation/Contamination Survey Supplement

Survey Log

## 6.0 REFERENCES

| ***Number*** | ***Title*** |
|---|---|
| ISO-7503-1 | *Evaluation of Surface Contamination* |
| NUREG-1507 | *Minimum Detectable Concentration/Activities for Typical Radiation Survey Instruments for Various Contaminants and Field Conditions* |
| NUREG-5480.11 | *Radiation Protection for Occupational Workers* |
| NUREG-1575 | *Multi-Agency Radiation Survey and Site Investigation Manual* |

## 7.0 ATTACHMENTS

Forms provided in this section illustrate the minimum requirements for their respective subject matter. Alternative documents or electronic data logging may be used providing the information is presented in a clear and concise manner and the content meets or exceeds the information required to complete these documents.

Attachment 1, Radiation/Contamination Survey Form

Attachment 2, Radiation/Contamination Survey Supplement

Attachment 3, Survey Log

# ATTACHMENT 1 – RADIATION/CONTAMINATION SURVEY FORM

| DATE: TIME: | INSTRUMENTATION USED | | | | | |
|---|---|---|---|---|---|---|
| SURVEY NUMBER: | **Model Inst/Det.** | **Serial Number** | **Calibration Due Date** | **% Efficiency** | **MDC/MDA (dpm/100cm$^2$)** | **Background (dpm/100cm$^2$)** |
| LOCATION: | | | | | | |
| SURVEYOR: | | | | | | |
| REVIEWED BY: | | | | | | |
| RSO/RTM: | | | | | | |
| Isotopes of Concern: | | | | | | |
| Description or drawing: | | | | | | |

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☐

All radiation readings in $\mu$r/hr unless otherwise noted.

(#)....denotes swipe location or fixed $\alpha/\beta$ readings.

#.....denotes G/A radiation readings.

#/#...denotes contact / 1 meter radiation readings.

*.....denotes highest radiation reading on contact.

Δ.....denotes static location.

# ATTACHMENT 2 - RADIATION/CONTAMINATION SURVEY SUPPLEMENT

| SURVEY NUMBER: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SURVEYOR: | | | | | LOCATION: | | | |
| Location | Exposure Rate (μR/hr) | | Fixed + Removable | | | Removable | | Comments |
| | Contact | 1 Meter | Gamma (cpm) | Alpha dpm/probe | Beta/Gamma dpm/probe | Alpha dpm/100cm$^2$ | Beta/Gamma dpm/100cm$^2$ | |
| 1 | | | | | | | | |
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| Reviewer | | | Date/Time: | | PHP | | | Date/Time: |

# ATTACHMENT 3 – SURVEY LOG

| Survey Number Project | # | Year | Date | Survey Description | Surveyor (Init.) |
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Reviewed/Approved By: _____ / _____

RSO/RTM Date

# ALAMEDA POINT PROJECT

## Standard Operating Procedure

# PREPARATION OF PORTABLE RADIATION AND CONTAMINATION SURVEY METERS AND INSTRUMETNS FOR FIELD USE

**ALAM-Tt-007**

**Revision 0**

Approved By:

| | |
|---|---|
| Project Health Physicst | Date |
| Project Manager | Date |

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PAGE

# 1.0 PURPOSE

This procedure is used to specify the general requirements for preparing portable radiation and contamination survey meters and instruments for use at field locations. The procedures presented below will be supplemented by the specific instrument operation manuals, Tetra Tech EC, Inc. (TtEC)-approved subcontractor procedures and specific work documents.

# 2.0 SCOPE

This procedure will be used by TtEC personnel and its subcontractors for preparation of portable radiation and contamination survey meters and instruments used on site. This procedure is intended to provide general instructions for preparing radiation and contamination survey meters and instruments for field operations. Development of specific procedures for the implementation of the requirements of this procedure is the responsibility of the end users.

In certain instances the requirements of this procedure may need to be added to or modified for specific field operations. Additional requirements and guidance for these cases will be provided in work-specific documents (i.e., Work Plan, etc.), will be subject to the same review process as this document, and will have precedence over the guidelines in this document as appropriate.

# 3.0 DEFINITIONS AND ABBREVIATIONS

**Acceptance Range** – A range of values that describes an acceptable instrument check result. An acceptance range is typically determined by adding ± 20 percent or ± 2$\sigma$ to the expected value.

**Calibration Sticker** – A label affixed to a properly calibrated instrument. The calibration sticker may be applied by the calibration facility or the end user. The calibration sticker should indicate the date through which the calibration is valid.

**Chi-Square Test** – A probability density function that gives the distribution of the sum of the squares of a number of independent random variables each with a normal distribution with zero mean and unit variance, that has the property that the sum of two or more random variables with such a distribution also has one, and that is widely used in testing statistical hypotheses especially about the theoretical and observed values of a quantity and about population variances and standard deviations. This test is used to evaluate the operation of an instrument, generally upon return from calibration.

**Check Log** – A form or series of forms which are used to document that an instrument was checked prior to usage in the field. Check logs can consist of multiple pages and must contain at least one page identifying the instrument. At least one page must also specify the parameters (source, geometry, etc.) used for the daily check. Space shall be provided to document the daily tests in the log. The log should be designed so as to clearly associate the required verifications with the signature or initials of the individual performing the check and date of each check.

**Instrument Efficiency** – A measure of the response (counts) obtained with a particular instrument when exposed to a known fluence of radioactive particles. Instrument efficiency has units of counts per particle.

# 4.0 PROCEDURE DETAILS

## 4.1 CALIBRATION

Instrument calibrations shall be performed using measuring and test equipment and National Institute of Standards and Technology (NIST) traceable sources. Calibrations will be performed at an accredited calibration laboratory. Calibration will be performed in accordance with the equipment manufacturers' manuals or a subcontractor's TtEC-approved procedure. Properly calibrated instruments shall be marked with a calibration sticker and include an accompanying calibration certificate.

Calibration shall be performed annually (± 15 days) or on a schedule consistent with the manufacturer's recommendation if more restrictive. The routine frequency may be extended by up to one additional month with written approval of the Project Health Physicist (PHP), or designee. However, the frequency of calibration may not be extended when instruments are being used for surveys of record (i.e., Final Status Surveys, Characterization Surveys, etc.) In addition to the routine frequency of performance, calibration shall be performed under the following conditions:

- Prior to placing a new instrument into service.
- After any major repair or alteration to the instrument or detector.

## 4.2 GENERAL CONSIDERATIONS

Determination of instrument background, chi-square testing and instrument efficiency should be conducted in a controlled environment. This typically will consist of a secured office or lab area located in a non-impacted area and which is known to be free of contamination. Testing jigs or apparatus may be employed as necessary to ensure that consistent, reproducible geometries are used, particularly during repeated measurements.

Table 4-1 gives suggested geometries to use for the most common instrument types to be used at Alameda Point. Alternate geometries can be used provided that they are more appropriate for the intended usage of the instrument.

## TABLE 4-1

## SUGGESTED GEOMETRIES FOR BACKGROUND MEASUREMENTS AND SOURCE CHECKS

| Measurement | Instrument/Detector Combinations | Probe Location |
|---|---|---|
| Exposure Rate | Eberline MicroRem Meter or equivalent with integral tissue equivalent plastic or sodium iodide (NaI) 1"x1" detector | contact[a] |
| Gamma | Eberline E-600 or equivalent with a Ludlum Model 44-10 or equivalent detector | 4 inches above ground surface/source |
| Beta/Gamma | Ludlum Model 3 portable survey meter with Eberline SHP380AB probe or equivalent | ¼ inch above ground surface/source |
| Alpha/Beta | Eberline E-600 or equivalent portable survey meter with Eberline SHP380AB or equivalent detector | ¼ inch from surface/source |

***Notes:***

[a] Field readings with exposure rate instruments are conducted at 1 meter; background determination, chi-square test and operational checks are typically performed at a more convenient distance. Geometry should be documented as appropriate on the relevant data forms and logs.

## 4.3 DETERMINATION OF INSTRUMENT BACKGROUND

The determination of an instrument specific background is an optional procedure which may be employed at discretion of the subcontractor. There is no regulatory requirement that necessitates the determination of background for each instrument. Instrument background determination is typically performed in a controlled environment and usually consists of a series of repeated background measurements that are statistically analyzed to obtain an expected range of valid background values. The established instrument background range can be used as a means of performing daily operation checks.

Instrument background determinations, when necessary, are considered valid for as long as the instrument has been properly maintained per the requirements of this procedure. If instrument backgrounds are required, a new background determination should be performed following each calibration.

When determining instrument background, the appropriate approved subcontractor's procedures shall be followed; however, any specific instructions for background determination in governing work-specific documents shall have precedence.

When required, background determinations will be documented on an approved subcontractor form or as specified in the work-specific procedures. The form should include the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector
- Conditions used for determination (geometry, radiation type, operating voltage, etc.)
- Date and time of determination
- Identification and signature or initials of technician
- Identification and signature of reviewer

The end result of a background determination should be to obtain an acceptance range for subsequent background checks.

## 4.4 CHI-SQUARE TEST

When chi-square tests are required by work-specific documents, the appropriate approved subcontractor's procedures shall be followed; however, any specific instructions for chi-square testing in governing work specific documents shall have precedence. When required, chi-square tests shall be performed annually (± 15 days), following calibration, or if there is reason to suspect that the instrument calibration may no longer be valid (i.e., inability to obtain a valid range of chi-square values).

Chi-square tests shall be performed with NIST traceable sources with isotopic content appropriate to the detector being evaluated and the anticipated contaminants in the survey area. The source should be of sufficient activity to yield a counting rate of 1,000 to 50,000 counts per minute (cpm). The source should not exceed 50,000 cpm.

When required, chi-square tests should be documented on an approved subcontractor form or as specified in the work-specific documents. The form should include the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector
- Conditions used for the test (geometry, radiation type, operating voltage, etc.)
- Source ID number
- Date and time of determination
- Identification and signature or initials of technician
- Identification and signature of reviewer

The chi-square test procedure will produce a chi-squared value ($\chi^2$), which should be between 10.11 and 30.14. Failure to obtain a chi-squared value in this range indicates a problem with either the instrument or the methodology used to perform the chi-square test and requires further investigation. The PHP should be notified of the failure to assist in planning a course of action.

## 4.5 INSTRUMENT EFFICIENCY FOR PORTABLE INSTRUMENTS

The instrument efficiency ($\varepsilon_i$) is the ratio between the net count rate (in cpm) of the instrument and the surface emission rate of the efficiency check source for a specified geometry. The surface emission rate is the $2\pi$ particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the efficiency check source.

The following equation is used to calculate the instrument efficiency in counts per particle:

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\pi}\left(W_A / S_A\right)}$$

Where,

$R_{S+B}$ = the gross count rate of the efficiency check source, measured in cpm
$R_B$ = the background count rate in cpm
$q_{2\pi}$ = the $2\pi$ surface emission rate of the calibration source (NIST traceable)
$W_A$ = the active area of the probe window in square centimeters ($cm^2$)
$S_A$ = the area of the source in $cm^2$

***Note***: This equation assumes that the dimensions of the efficiency check source are sufficient to cover the window of the instrument detector. If the dimensions of the efficiency check source are smaller than the detector's window, set $W_A$ equal to the dimensions of the efficiency source (i.e., set the quotient of $W_A$ and $S_A$ equal to 1).

Instrument efficiency shall be determined for all instruments and radiation and contamination survey meters that are to be used for alpha and beta surveys prior to use for field operations. Instrument efficiency is dependent upon energy of the incident radiation. Multiple energy-specific instrument efficiencies may be determined when isotopes with significantly varying energies are analyzed.

The procedures in the approved subcontractor's procedures shall be followed to determine the instrument efficiency for those instruments for which it is required. In instances where governing work-specific documents specify a means or expanded scope of inclusion for instrument efficiency determination, they shall have precedence.

All instrument efficiency determinations should be documented on an approved subcontractor form or as specified in the work-specific documents. The form should include the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector
- Conditions used for determination (geometry, radiation type, operating voltage, etc.)
- Source-specific information (ID number, surface emission rate, area),
- Detector window area
- Date and time of determination
- Identification and signature or initials of technician
- Identification and signature of reviewer (typically the PHP)

The resulting instrument efficiency should be reported in units of counts per particle.

## 4.6 OPERATION CHECK

An operation check for each instrument should be performed at the beginning of each workday that a particular instrument is used. The operations check should include the following checks at a minimum:

- Check that instrument calibration is still valid (date on sticker not yet passed)
- Check the instrument (including the probe) for physical defects (knobs, displays, cables, connectors, Mylar windows, etc.)
- Check of instrument battery (per manufacturers' instructions)
- Source check (should give consistently reproducible results with same source)

Failure of any of the above checks shall result in the instrument being removed from active service until the condition can be addressed. The PHP should be notified of any instrument failing an operations check for reasons other than failure of a battery check. In cases of battery check failure, the battery should be replaced and the check repeated.

The specified checks should each be performed every day and documented on a new line of the check log. A separate check log shall be maintained for each instrument. The check log shall contain the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector

- Conditions used for the check (geometry, radiation type, etc.)
- Source ID number
- Verification of current calibration
- Verification of physical condition
- Verification of battery check
- Verification that source check is in acceptance range
- Date of operational check
- Signature or initials of technician
- Identification and signature of reviewer

Of the required information given above, only the verifications, date and signature or initials need to be completed on a daily basis. The remaining information can be completed once and kept in the check log with the additional pages for daily checks, provided that none of the information changes. If the information changes, then a new check log should be started.

### 4.7 MAINTENANCE

Instruments shall be stored in areas, which prevent damage by movement, accumulation of moisture or dust. Detector covers shall be used for storage when practical.

Instrument maintenance (except external adjustments and cable or Mylar window replacements) shall be performed by the manufacturer or an approved vendor.

## 5.0 RECORDS

Records that result from this procedure may include forms that document background determinations, chi-square tests, instrument efficiency and check logs. Record forms shall be obtained from approved subcontractor procedures or specified in work-specific procedures.

## 6.0 REFERENCES

| *Number* | *Title* |
|---|---|
| None | |

## 7.0 ATTACHMENTS

None.

# ALAMEDA POINT PROJECT

## Standard Operating Procedure

# SAMPLING PROCEDURES FOR RADIOLOGICAL SURVEYS

## ALAM-Tt-009

## Revision 0

Approved By:

| | |
|---|---|
| _____ | _____ |
| Chemist | Date |
| _____ | _____ |
| Project Health Physicst | Date |
| _____ | _____ |
| Project Manager | Date |

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# 1.0 PURPOSE

This procedure will be used by Tetra Tech EC, Inc. (TtEC) personnel and its subcontractors at Alameda Point Project (ALAM) to perform swipe sampling and sampling of various types of media including soil, sediment, solid material (such as concrete, brick, porcelain, wood), and water. This procedure also details sample packaging and transporting samples to the laboratory.

# 2.0 SCOPE

This procedure shall be implemented by TtEC staff and subcontractor personnel when collecting samples on field projects related to radiological surveys.

# 3.0 DEFINITIONS AND ABBREVIATIONS

**Swipe Samples** – Swipe samples are materials, which after being wiped over a surface, are analyzed to determine the presence of removable radioactivity on the surface area that was wiped.

**Soil Samples** – Soil samples are defined as soil collected for analytical purposes. Soil samples will be collected from the top 15 centimeters (cm) of the surface, unless otherwise noted in the Work Plan.

**Sediment Samples** – Sediment samples are defined as a collection of clay, silt, sand, and/or gravel deposited by water, wind, or glaciers used for analytical purposes.

**Solid Material Samples** – Solid material samples are defined as pieces of concrete, brick, porcelain, wood, or any other hard material collected for analytical purposes from buildings or surrounding areas. The samples could include accumulations from ventilation systems or drain systems.

**Liquid Samples** – Liquid samples are defined as liquid collected for analytical purposes from sinks, drain piping, sewer systems, rinsate, groundwater, leachate, liquid investigation-derived waste, and low-point accumulation areas inside of buildings, sumps, and excavation pits.

# 4.0 SAMPLING PROCEDURE DETAILS

## 4.1 GENERAL PROCEDURES

Field instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.

Anytime this procedure is in effect, the Project Health Physicist (PHP) (or qualified designee) should ensure, by periodic personal observation, that samples are appropriately collected and controlled.

Surface scan surveys are to be performed at each location before initiating sampling. This will identify the presence of gross contamination, which will require that samples and equipment be treated as radioactive and handled in accordance with applicable license requirements. Samples will be recorded on chain-of-custody (COC) documentation.

## 4.2 SAMPLING PROCEDURE PROCESS

Sample activities will be recorded in the field logbook as directed by the applicable Sampling and Analysis Plan (SAP). Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting samples at each location.

### 4.2.1 SWIPE SAMPLING

Swipe samples will be obtained in accordance with ALAM-Tt-006, *Radiation and Contamination Surveys*. Swipe samples will be documented in the sample logbook as applicable. Sample COC records shall be completed in accordance with the SAP.

### 4.2.2 SOIL SAMPLING

Because standard surface soil contamination criteria for radionuclides are applicable to the average concentration in the upper 15 cm of soil, the sampling protocol described here is based on obtaining a sample of this upper 15 cm. Special situations, such as sampling at depths greater than 15 cm, evaluating trends or airborne deposition, determining near-surface contamination profiles, and measuring non-radiological contaminants, may require special sampling procedures. These special situations will be evaluated and incorporated as the need arises.

Samples will be collected with a hand-auger, hollow-stem auger, split-spoon sampler, disposable scoop, or equivalent. The soil removed for sampling must be sufficient to yield a sample of sufficient volume for the sample container being used. Soil samples will be collected and handled as follows:

1. Loosen the soil at the selected sampling location to a depth of approximately 15 cm, using a trowel or other digging instrument.
2. Remove large rocks, vegetation and foreign objects. In some cases, however, these objects may be the source of the contamination and may be collected as separate samples for characterization.
3. Place as much soil as practical into a 250-milliliter (mL) wide-mouth plastic bottle or plastic 500-mL Marinelli container.
4. If sample containers are not readily available, samples may be collected in a plastic bag for subsequent transport to the laboratory for sample preparation.
5. Tape the cap of the container in place or seal the ziplock plastic bag.
6. Label the sample container in accordance with the SAP.

7. Document all samples collected in the sample logbook as applicable. Sample COC records shall be completed in accordance with the SAP.
8. Transport samples to the on-site laboratory for analysis as soon as possible after sample collection. Sample packaging and shipment procedures for transporting samples to an off-site laboratory are described in Section 4.3 of this procedure.
9. Clean or decontaminated tools will be used at each sampling location. Sampling tools will be decontaminated as described in the SAP.

### 4.2.3 SEDIMENT SAMPLING

Several methods are available to collect sediment samples. The tools used will be appropriate to the circumstances and may include use of trowels, augers, or other hand tools. Sediment sampling will be conducted as follows:

1. A hand-auger, trowel or similar device will be used to access each sampling location. The sample collection tool will be selected based on physical limitations accessing the sample location.
2. Place as much material as practical into a 250-mL wide-mouth plastic bottle or plastic 500-mL Marinelli container.
3. Follow steps 4 through 9 of Section 4.2.2 to complete sample collection.

## 4.3 SAMPLE PACKAGING AND TRANSPORT

Samples will be delivered for analysis to an on-site laboratory via a box, cooler, or similar container (ice is not required if only radiological analysis will be performed) along with the completed COC. Upon arrival at the on-site laboratory, the sampler will sign the "Relinquished By" on the COC, and the laboratory manager will sign the "Received By" on the COC. The white copy of the COC will be submitted with the final analytical report of data from the on-site laboratory to the TtEC project chemist, the pink and yellow copies will be maintained by the on-site laboratory for their project files, and the manila copy will be submitted to the TtEC project chemist. A duplicate of the manila copy may also be kept in the TtEC project file on site.

Ten percent of the solid or liquid samples analyzed by the on-site laboratory will be sent to an off-site laboratory for quality assurance purposes. Additional samples may be sent for off-site analysis, as described in the Work Plan. A new COC will be generated by the laboratory manager for samples designated for off-site laboratory analysis. Samples designated for transport off site will be packaged in accordance with applicable Department of Transportation (DOT) and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials as necessary to prevent container breakage.

For samples transported by an off-site laboratory courier, two custody seals will be taped across the lid of the box or cooler: one seal in the front and one seal in the back. The appropriate section(s) of the COC will be completed by the assigned courier. The box/cooler and the top two copies (white and pink) of the COC will then be released to the courier for transportation to the laboratory.

For samples shipped via a commercial carrier, the COC will include the airbill number, and the "Received By" box will be labeled with the commercial courier's name. The top two copies (white and pink) of the COC will be sealed in a resealable bag and then taped to the inside of the sample cooler lid or placed inside the box. The yellow copy of the COC will be maintained by the on-site laboratory and the manila copy will be submitted to the TtEC project chemist. A duplicate of the manila copy may also be kept in the TtEC project file on site. The box/cooler will be taped shut with strapping tape as necessary. Two custody seals will be taped across the lid: one seal in the front and one seal in the back. The pouch for the airbill will be placed on the box/cooler and secured with clear tape. The airbill will be completed for priority overnight delivery and placed in the pouch. If multiple boxes/coolers are being shipped, then the original airbill will be placed on the box/cooler with the COC, and copies of the airbill will be placed on the other boxes/coolers. The number of packages should be included on each airbill (1 of 2, 2 of 2). Saturday deliveries should be coordinated in advance with the designated off-site laboratory and placement of "Saturday Delivery" stickers on each box and/or cooler to be shipped should be confirmed with the commercial courier prior to release. Prepared packages will also be surveyed prior to shipment.

## 5.0 RECORDS

Sample collection records will include field logbooks and COCs. These records will be completed and maintained in accordance with the SAP.

## 6.0 REFERENCES

| *Number* | *Title* |
|---|---|
| ALAM-Tt-006 | *Radiation and Contamination Surveys* |

## 7.0 ATTACHMENTS

None.

# ALAMEDA POINT PROJECT

## Standard Operating Procedure

# RELEASE OF MATERIALS AND EQUIPMENT FROM RADIOLOGICALLY CONTROLLED AREAS

## ALAM-Tt-012

## Revision 0

Approved By:

| | |
|---|---|
| Project Health Physicst | Date |
| Project Manager | Date |

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# 1.0 PURPOSE

The purpose of this procedure is to specify the radiological survey requirements for releasing materials and equipment from radiologically controlled areas (RCAs).

# 2.0 SCOPE

This procedure will be used by Tetra Tech EC, Inc. (TtEC) personnel and its subcontractors to release materials from RCAs.

# 3.0 DEFINITIONS AND ABBREVIATIONS

**Contamination** – Radioactive material in any place it is not desired. Contamination may be due to the presence of alpha particle, beta particle or gamma ray emitting radionuclides.

**Fixed Surface Contamination** – Contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk swipe or masslin.

**Radiologically Controlled Area (RCA)** – An area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or to prevent the release of radioactive materials to the uncontrolled areas.

**Release for Unrestricted Use** – The authorization to remove or reuse equipment and/or material from a RCA. Such authorization will be based on review of survey data confirming that the material and/or equipment being released does not exhibit radiation levels exceeding those in Table 4-1.

**Removable Surface Contamination** – Contamination that is readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk swipe or masslin.

# 4.0 PROCEDURE DETAILS

## 4.1 GENERAL

Surveys for fixed and removable surface contamination shall be conducted and documented in accordance with ALAM-Tt-006, *Radiation and Contamination Surveys.*

Items presented for release shall be surveyed in an area of relatively low background.

## 4.2 LIMITATIONS

This procedure shall not be used for personnel surveys. Personnel will be surveyed in accordance with ALAM-Tt-022, *Personnel Protective Equipment, Monitoring, And Decontamination.*

## 4.3 RELEASE PROCEDURE

### 4.3.1 MATERIAL HISTORY

Upon receipt of an item presented for release from RCAs, the history of the item should be determined. This determination should include if possible:

- The current and past use of the item.
- The location(s) in which the item was used or stored.
- If the item was in an area where radioactive material was used or stored.

This history will be used, if applicable, to evaluate the potential for contamination to be present on inaccessible surfaces of the item.

### 4.3.2 CONTAMINATION SURVEYS

All accessible surfaces will be surveyed for removable and fixed surface contamination in accordance with ALAM-Tt-006, *Radiation and Contamination Surveys.*

Swipes collected for removable surface contamination shall be analyzed with low-background gas-proportional counters. Typically a Protean IPC 9025 and/or a Tennelec Series 5 XLB gas-flow-proportional alpha/beta radiation counter will be employed to count swipes for the release of materials and equipment. As a backup to the gas-flow-proportional counters, an Eberline HandeCount portable alpha/beta counter (or equivalent) may be used.

Following the scan survey, the number of static survey measurements to be collected shall be determined by:

- Size and history of the item.
- Preliminary results of the swipe and scan surveys.
- If an increase in the audible and/or digital/analog count rate was detected.
- If during the survey, the Radiological Control Technician (RCT) determines that there may be fixed activity present.

### 4.3.3 INACCESSIBLE SURFACES

Items with inaccessible surfaces, that may have been exposed to contamination or it is unknown if they have been exposed to contamination, should be disassembled as

completely as possible to facilitate release surveys. Items with inaccessible surfaces will not be released from an RCA, unless evaluated and documented by the Project Health Physicist or designee in conjunction with the Radiological Affairs Support Office (RASO).

### 4.3.4 RELEASE OF MATERIAL AND EQUIPMENT

The following steps shall be taken for release of material and equipment:

1. If the results of the swipe, scan and static surveys do not exceed the limits of Table 4-1 then the material may be released for unrestricted use.
2. If the swipe, scan or static survey results indicate contamination, which exceeds the limits of Table 4-1, the material shall not be released for unrestricted use. Material and equipment that cannot be released for unrestricted use will be evaluated for decontamination in accordance with ALAM-Tt-016, *Decontamination of Equipment and Tools,* or packaged for disposal.
3. Results of the swipe, scan and static surveys shall be documented in accordance with ALAM-Tt-006, *Radiation and Contamination Surveys.*
4. If the equipment and/or materials are being returned to a vendor or removed from the Alameda Point, a completed Attachment 1 – Unconditional Release of Equipment or Materials Form – will accompany the equipment and/or material.

# TABLE 4-1

## RELEASE LIMITS FOR MATERIALS AND EQUIPMENT

| Radiation Type | Release Limits[1] (Fixed) (dpm per 100 $cm^2$) | Release Limits[1] (Removable) (dpm per 100 $cm^2$) |
|---|---|---|
| Alpha ($\alpha$) | 100 | 20 |
| Beta ($\beta$-) | 1000 | 200 |
| Gamma ($\gamma$) | 5,000 | 1,000 |

***Notes:***

[1] These limits are based on AEC Regulatory Guide 1.86 (AEC, 1974)

AEC – Atomic Energy Commission
$cm^2$ – square centimeters
dpm – disintegrations per minute

## 5.0 REFERENCES

| *Number* | *Title* |
|---|---|
| AEC Regulatory Guide 1.86 | *Termination of Operating Licenses for Nuclear Reactors* |
| ALAM-Tt-006 | *Radiation and Contamination Surveys* |
| ALAM-Tt-016 | *Decontamination of Equipment and Tools* |
| ALAM-Tt-022 | *Personnel Protective Equipment, Monitoring, and Decontamination* |

## 6.0 ATTACHMENTS

Attachment 1 – Unconditional Release of Equipment or Materials Form

## ATTACHMENT 1

## UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

| Survey #: | Date: |
|---|---|
| Description of equipment or materials: | |
| | |
| | |
| | |
| | |
| | |

**SURVEY EQUIPMENT:**

| | | | | |
|---|---|---|---|---|
| Model No: | S/N: | Background: | Eff: | Cal Due Date: |
| Model No: | S/N: | Background: | Eff: | Cal Due Date: |
| Model No: | S/N: | Background: | Eff: | Cal Due Date: |

**CONTAMINATION LEVELS:**

| | | |
|---|---|---|
| | dpm/100 $cm^2$ $\beta\gamma$ | Removable |
| | dpm/100 $cm^2$ $\alpha$ | Removable |
| | dpm/100 cm $\beta\gamma$ | Fixed |
| | dpm/100 $cm^2$ $\alpha$ | Fixed |

This is to certify that the above described equipment or materials have been surveyed and found to be within acceptable surface contamination levels for unconditional release as required by AEC Regulatory Guide 1.86.

| Radiological Control Technician: | Date/Time: |
|---|---|
| Disposition of equipment or materials: | |
| | |
| | |
| Reviewed By: | Date: |

# ALAMEDA POINT PROJECT

## Standard Operating Procedure

# DECONTAMINATION OF EQUIPMENT AND TOOLS

## ALAM-Tt-016

## Revision 0

Approved By:

| | |
|---|---|
| Project Health Physicst | Date |
| Project Manager | Date |

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# 1.0 PURPOSE

This procedure provides instruction and methods for the decontamination of equipment and tools that are contaminated with radiation.

# 2.0 SCOPE

This procedure provides the methods Tetra Tech EC, Inc. (TtEC) personnel and its subcontractors at Alameda Point (ALAM) will use for decontamination of equipment and tools that are contaminated with radioactive material.

# 3.0 DEFINITIONS AND ABBREVIATIONS

**Decontamination** – The processes whereby contamination can be safely and effectively removed from equipment and tools.

**HERCULITE®** – A plastic or polyethylene floor covering and containment material used for decontamination operations. HERCULITE is a brand name.

**Material Safety Data Sheet (MSDS)** – Manufacturer directions, safety information and limitations for use of decontamination-related solvents or cleaning solution.

# 4.0 PROCEDURE DETAILS

## 4.1 GENERAL

### 4.1.1 PRECAUTIONS

The following precautions shall be observed during decontamination activities:

- Decontamination of contaminated tools or equipment shall be performed under the supervision of the Radiological Control Technician (RCT) providing the job coverage.

- Controls to contain the spread of loose contamination during the decontamination activity shall be planned and established prior to the decontamination of equipment, material and tools.

- Use of chemicals or solvents for decontamination purposes that have the potential to produce mixed waste shall be avoided whenever possible. Use of these chemicals or solvents requires the prior approval of the Project Health Physicist (PHP) and Radiological Affairs Support Office (RASO).

- Survey instruments that will be used to survey suspected contaminated equipment or tools should be protected (wrapped in plastic, etc.) against possible contamination before use.

- Abrasive measures should only be applied to surfaces that are not critical for operation of devices being returned to working condition.

- Electric power tools should not be used on a wet working surface. Liquids will be kept away from electric power tools.

### 4.1.2 LIMITATIONS

The following limitations apply to decontamination activities:

- Protective clothing worn by the personnel involved in decontamination activities as determined by the PHP.

- Decontamination cleaning solvents/solutions shall only be used in accordance with the directions and limitations listed on the manufacturer-supplied MSDS.

- Contamination controls shall be observed throughout a decontamination operation.

- Radiation and contamination surveys shall be performed in accordance with the provisions of procedure ALAM-Tt-006, *Radiation and Contamination Surveys.*

- Release of equipment and tools from the decontamination area shall be performed in accordance with the provisions of ALAM-Tt-012, *Release of Materials from Radiologically Controlled Areas*.

## 4.2 PRE-DECONTAMINATION PREPARATION

The following steps shall be used for pre-decontamination preparation:

1. The PHP, or designee shall review available data regarding the item(s) requiring decontamination and develop a decontamination approach based on conditions of the Radiation Work Permit (RWP) and the cost-effectiveness of the operation versus disposal costs.
2. A radiological survey shall be performed to identify the level of radioactive contamination that is present by an RCT on objects that are to be removed from a controlled area.

## 4.3 ESTABLISHMENT OF THE DECONTAMINATION AREA

The PHP, working with the Project Manager, shall determine a location for setup of the decontamination area. As applicable to the specific decontamination activity being performed, the decontamination area may consist of and contain one or more of the following (as needed):

- Covered floor surfaces. A double-layer of HERCULITE (or equivalent) may be laid on the floor at the direction of the RCT.
- Covered (HERCULITE or equivalent) wall surfaces.
- Engineering controls [high-efficiency particulate air (HEPA) ventilation, vacuum cleaners, containment tent walls, glove bags, etc.]. Engineering controls shall be determined on the basis of the as low as reasonably achievable (ALARA) philosophy.
- Safe, sturdy work stations with contamination-resistant surfaces, tables that will support decontamination attempts on heavy pieces of equipment.
- Adequate lighting, electrical and compressed air supply for the operation of electrical and/or pneumatic-driven equipment.
- Overhead lifting equipment.
- Adequate supply of approved cleaning solutions and solvents; adequate supply of decontamination equipment such as:
  - Light-duty decontamination equipment such as paper wipes, paper towels, masslin towels, etc.
  - Medium- to heavy-duty decontamination equipment such as scrub pads, wire brushes, steel wool, files, sandpaper, etc.
  - Fully stocked hand tool kit for disassembly of contaminated equipment
  - Power tools, such as drills, saws, needle-guns, electric screwdrivers, etc.
  - Radioactive material storage bags and stickers
  - Buckets, barrels or drums for the storage of contaminated liquids, sludges or slurries
  - Blotter paper or sorbent
  - Approved absorbent material such as oil dry
  - Storage drums/bags for the storage of contaminated protective clothing
  - *Proper surveillance instruments (air monitor/sampler, contamination* monitor, friskers, exposure rate meter, etc.)
  - Adequate supply of personal protective clothing, gloves, respiratory equipment

- A designated area within the decontamination area for the segregation of radioactive waste
- Fire extinguisher(s)

## 4.4 ITEM PREPARATION FOR DECONTAMINATION

Contaminated or controlled items should always be escorted under the direction of a RCT to the decontamination area.

If an item is wrapped, position it so that the written information on the wrapping is visible and then perform the following:

- The RCT shall direct the removal of the item from the wrapping in such a manner (rolling plastic wrapping inside out, etc.) to control the spread of contamination.
- An item that is highly contaminated with removable contamination may need to be misted with an approved liquid to minimize the possibility of creating airborne contamination.
- Once the item has been removed from the wrapping and has been properly positioned, discard the wrapping as radioactive waste.

The following conditions shall be considered for the decontamination of equipment and tools:

- Any equipment with inaccessible areas shall be dismantled so that all surfaces are accessible for decontamination and survey.
- Decontamination shall be performed in a safe, effective manner.
- The RCT shall be notified immediately if the job conditions change (e.g., suspected asbestos is found, the presence of mercury in a switch or a light bulb, a fluid leak, or any other special circumstances).
- A fire watch shall be assigned to watch if any spark-producing decontamination techniques (grinding, etc.) are used. There shall be a dedicated fire extinguisher located within the decontamination area.
- The decontamination area shall remain organized and free of debris. The Radiological Control/ Decontamination Technicians shall "clean as they go."
- Air monitoring for airborne radioactivity shall be conducted as needed or directed by the PHP.
- A HEPA vacuum cleaner may be used during the decontamination operation.

## 4.5 DECONTAMINATION OF REMOVABLE CONTAMINATION

When an item is properly positioned for decontamination and the pre-survey activities have been completed, the RCT will perform one or more of the following activities in accordance with the decontamination action approach approved by the PHP:

- Moisten the surface of the item with an approved liquid.
- Fold a paper or cloth wipe into sections, using one surface of the wipe; gently wipe contamination off in one direction away from the user's body to reduce the possibility of personnel contamination.
- Re-fold the paper or cloth wipe so that a clean surface is available to prevent cross-contamination and continue until item is ready for survey.
- For some equipment or tools, duct tape will effectively remove removable contamination. Wrap the duct tape loosely around the gloved hand, adhesive side out. Roll the tape over the contaminated area.

## 4.6 DECONTAMINATION OF FIXED CONTAMINATION

There are many techniques that can be used to remove fixed contamination. The general idea is to remove the material that is fixing the activity to the surface, or remove a very thin layer of the surface material. It is very important to note that fixed contamination decontamination methods can and do result in the creation of removable surface contamination. This creates a condition that may generate airborne radioactive materials. The activities should be controlled in such a manner that airborne radioactivity is minimized, and air sampling shall be performed during these operations to properly evaluate any resultant airborne radioactivity.

For the purposes of this procedure, the potential removal techniques have been divided into the following two categories:

- Abrasive hand decontamination
- Power tool decontamination

In addition, the following methods could be used, but are not defined in this procedure and would require the development of a Task-specific Plan or Work Instruction:

- Machine decontamination (use of abrasive bead blasters, grit blasters, high-pressure water wash systems, etc.)
- Cleaning solutions/solvents (use of ultrasonic cleaners, acid baths, electropolishing, etc.)

The actual method or combination of methods applied will be in accordance with the decontamination approach approved by the PHP.

### 4.6.1 ABRASIVE HAND DECONTAMINATION

Abrasive hand decontamination shall be performed in the following manner:

1. Remove as much removable contamination as possible as indicated in Section 4.5 of this procedure.
2. Moisten the surface of the item(s) to help contain contamination.
3. Use an abrasive cleaning tool (e.g., sandpaper, steel wool, steel brush, hand grinder, etc.) to loosen fixed contamination. Clean in one direction only, away from the body to prevent personnel contamination.
4. Continue to moisten the surface of the item(s) to contain contamination.
5. Remove as much of the loosened contamination as possible as per Section 6.5 of this procedure.

### 4.6.2 POWER TOOL DECONTAMINATION

Power tool decontamination shall be performed under the direction of the RCT, with concurrence from the PHP.

#### 4.6.2.1 Electric Power Tools

Electric power tools that may be used in decontamination operations are:

- Drills – used to drill out contaminated areas, to disassemble contaminated components, and when used with grinding wheels or disks, may be used as an abrasive tool
- Saws – used to separate contaminated pieces from clean pieces
- Grinders – used to grind fixed contamination from surfaces
- Electric screwdrivers – used in the disassembly of component parts

#### 4.6.2.2 Air-powered Tools

Air-powered tools that may be used in decontamination operations are:

- Needle gun – a pneumatic tool that can remove contamination from concrete and/or steel surfaces
- Socket tools or impact hammer – used in disassembly of component parts
- Jackhammer/rotary hammer – a pneumatic tool which can remove contamination from concrete and/or steel surfaces

#### 4.6.2.3 Decontamination of Power Tools

Power tool decontamination shall be performed in the following manner:

1. Remove as much removable contamination as possible as per Section 4.5 of this procedure.
2. Moisten the surface of the item lightly to help contain contamination. Use a spray bottle for moistening.
3. Whenever feasible, the use of containment devices (e.g., glove box, etc.) should be used to contain the spread of contamination when using power tools for decontamination operations.
4. Use the power tool to remove fixed contamination. Clean in one direction only and away from the body to prevent personnel contamination.

### 4.7 POST-DECONTAMINATION

Following decontamination procedures, the RCT shall perform a release survey. The survey will include the work area and any tools, equipment and materials used during decontamination activities and shall be conducted in accordance with SOP ALAM-Tt-012, *Release of Materials from Radiologically Controlled Areas.* Post-decontamination release shall be performed as follows:

1. If the item satisfies the criteria for release, remove the item to a holding area and document results.
2. If the item remains contaminated, inform the PHP and repeat the decontamination.
3. If the item remains contaminated, attempt a third decontamination only by direction of the PHP.

If an item cannot be effectively or economically decontaminated, the Project Manager may direct the crew to volume-reduce (reduce to component parts) the equipment, material, or tools as much as possible. If the item is expendable, the individual parts may be surveyed and released.

Any tools, equipment or materials that cannot be decontaminated will be packaged in an appropriate waste container for subsequent disposal as radioactive waste. The waste containers will be staged in an area agreed upon by RASO and the Navy.

After decontamination operations have been completed, a RCT shall perform a release survey of the decontamination area in accordance with ALAM-Tt-006, *Radiation and Contamination Surveys* and ALAM-Tt-012, *Release of Materials form Radiologically Controlled Areas.*

## 5.0 RECORDS

The records generated by the use of this procedure are documented in accordance with the provisions of ALAM -Tt-012, *Release for Materials from Radiologically Controlled Areas.*

## 6.0 REFERENCES

| ***Number*** | ***Title*** |
|---|---|
| ALAM-Tt-006 | *Radiation and Contamination Surveys* |
| ALAM-Tt-010 | *Radiologically Controlled Areas - Posting and Access Control* |
| ALAM-Tt-012 | *Release of Materials from Radiologically Controlled Areas* |

## 7.0 ATTACHMENTS

None.

# ALAMEDA POINT PROJECT

## Standard Operating Procedure

## RADIOLOGICAL PROTECTIVE CLOTHING SELECTION, MONITORING, AND DECONTAMINATION

## ALAM-Tt-022

## Revision 0

Approved By:

| | |
|---|---|
| Project Health Physicst | Date |
| Project Manager | Date |

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# 1.0 PURPOSE

This procedure provides the guidance for selecting protective clothing, performing personnel surveys, and decontaminating personnel.

# 2.0 SCOPE

This procedure will be used by Tetra Tech EC, Inc. (TtEC) personnel and its subcontractors while performing activities in known or suspected areas with radioactive contamination at Alameda Point (ALAM).

# 3.0 DEFINITIONS AND ABBREVIATIONS

**Contaminated Area** – Any area where removable surface contamination levels exceed the following limits in Table 3-1:

**TABLE 3-1**
**EQUIPMENT AND MATERIAL SURFACE CONTAMINATION LIMITS**

| Radionuclide | Removable[1] (dpm/100 $cm^2$) | Fixed[1] (dpm/100 $cm^2$) |
|---|---|---|
| Alpha | 20 $\alpha$ | 100 $\alpha$ |
| Beta (Strontium-90) | 200 $\beta^-$ | 1,000 $\beta^-$ |
| Beta / Gamma | 1,000 $\beta^-, \gamma$ | 5,000 $\beta^-, \gamma$ |

***Notes:***

[1] Limits for equipment and materials based on Regulatory Guide 1.86 (AEC, 1974)
AEC – Atomic Energy Commission
$cm^2$ – square centimeters
dpm – disintegrations per minute
Types of radiation: $\alpha$ - alpha, $\beta$ - beta, $\gamma$ - gamma

**Hot Particle** – A discrete, minute, fragment of radioactive material.

**Radiologically Controlled Area (RCA)** – An area containing radioactive materials to which access is controlled to protect individuals from exposure to ionizing radiation.

# 4.0 PROCEDURE DETAILS

## 4.1 SELECTION OF PROTECTIVE CLOTHING

The following factors should be considered when selecting protective clothing (PC):

- The levels and types of radiological material present or expected in the work area.
- The presence of chemical hazards.
- The base in which the contamination is carried (dry, wet, oily).
- The work to be performed or work in progress.
- The location of the contamination (e.g., floor, walls, overhead, air handling systems, sewer systems).
- The physical configuration of the work area.
- Environmental conditions such as heat and humidity.
- Exposure situation (vapor, pressured splash, liquid splash, intermittent liquid contact, and continuous liquid contact).
- Toxicity of the radioactive materials and/or chemical(s) (ability to permeate the skin and systemic toxicity).
- Physical properties of the contaminant (vapor pressure, molecular weight, and polarity).
- Functional requirements of the task (dexterity, thermal protection, fire protection, and mechanical durability requirements).

Table 4-1 provides guidance for the selection of PCwhen radiological hazards are present or suspected.

## TABLE 4-1

## GUIDE FOR THE SELECTION OF RADIOLOGICAL PROTECTIVE CLOTHING

| Removable Contamination Levels | Clothing for Access Only No Work * | Clothing for Work or Access During Work * |
|---|---|---|
| General contamination levels < 1,000 dpm/100 $cm^2$ | Level D PPE | Level D PPE |
| General contamination levels > 1,000 dpm/100 $cm^2$, but ≤ 10,000 dpm/100 $cm^2$ | Glove liners<br>Gloves<br>Booties, cloth or PVC<br>Tyvek<br>Rubber shoe covers** | Glove liners<br>Gloves<br>Booties, cloth or PVC<br>Tyvek<br>Rubber shoe covers** |
| General contamination levels > 10,000 dpm/ 100 $cm^2$, but ≤ 100,000 dpm/100 $cm^2$ | Glove liners<br>Gloves<br>Booties, cloth or PVC<br>Tyvek<br>Cap (or hood)<br>Rubber shoe covers** | Glove liners<br>Gloves<br>Booties, cloth or PVC<br>Tyvek<br>Cap (optional)<br>Hood<br>Rubber shoe covers** |
| General contamination levels > 100,000 dpm/100 $cm^2$ | Glove liners<br>Gloves (2 pair)<br>Booties, cloth or PVC<br>Tyvek<br>Cap (optional)<br>Hood<br>Rubber shoe covers** | Glove liners<br>Gloves (2 pair)<br>Booties (2 pair), cloth or PVC<br>Tyvek (2 pair)<br>Cap<br>Hood<br>Rubber shoe covers** |

***Notes:***

* Plastics or partial plastics may be required anytime water or liquid chemicals are present, such as when handling wet components.

** Composition of Rubber shoe covers will be selected based on work area conditions and presence of any chemical hazards.

$cm^2$ – square centimeters
dpm – disintegrations per minute
PPE – personal protective equipment
PVC – polyvinyl chloride

The guidelines specified in Table 4-1 for PC selection may be modified under unusual circumstances. The following are examples:

- Wet areas – Where splashing water or spray is present, use rain suits in addition to the protective clothing listed in Table 4-1. A second set of coveralls may not be necessary when a rain suit is worn.

- Standing water - In addition to the clothing requirements for wet areas, use hip boots or waders for deep standing water areas.
- Face shields – Consider for use when there is significant beta radiation or a likelihood of water splashing and respirators are not required.
- High temperature areas – Consult with the Project Health Physicist (PHP) and Site Health and Safety Specialist (SHSS).

## 4.2 PROCEDURE PROCESS

### 4.2.1 DONNING PROTECTIVE CLOTHING

1. Select the appropriate PC.
2. Inspect the clothing for holes, tears, or other indications of damage. If damaged, remove PC from service.
3. Don clothing.

### 4.2.2 REMOVAL OF PROTECTIVE CLOTHING

1. Remove any tape and place in the designated collection receptacle.
2. Remove outer gloves, if worn.
3. Remove coveralls, if worn, by peeling off inside out and rolling downward over the shoes or inner booties.
4. Remove booties.
5. Carefully place coveralls in the designated collection receptacle.

> **CAUTION**: Pushing clothing or trash into an already full collection container to compress the contents is forbidden as the act can result in the potential for airborne radioactivity.

6. Have the Radiological Control Technician (RCT) perform a personnel exit survey.

The sequence for protective clothing removal may vary from that described above:

- At the discretion of the RCT, providing job coverage.
- As designated in the assigned Radiation Work permit (RWP).
- Dependent upon radiological and hazardous material conditions encountered during the work evolution.

### 4.2.3 MONITORING

#### 4.2.3.1 Exit Surveys

**Note:** Site conditions may merit only a hand and foot survey. If this is the case, only the hands and shoe bottom are surveyed by the RCT.

1. Use the portable instrument staged for the area of concern, which should have both a visual and an audible response.
2. Ensure that the instrument is set on slow response, if available, and operating with an audible response.
3. Verify that the instrument is operational on the lowest scale and that the area background count rate is acceptable.
4. Hold the detector with the window at approximately ½ inch from the surface being monitored.
5. Move the detector over the surface being monitored at a rate not to exceed 2 to 3 inches per second.
6. If an increase in the audible response is noted, then cease detector movement and allow the meter 5 to 10 seconds to stabilize.
7. Pause (approximately 5 seconds) at the nose and mouth area to check for indications of inhalation/ingestion of radioactive material.
8. Pay particular attention to hands, feet (shoes), elbows, knees, or other areas with a high potential for contamination.
9. If no contamination can be detected as indicated by an alarm or by an audible or visual response distinguishable from background, then exit the area.
10. If an audible or visual response distinguishable from background is noted, then the RCT will further investigate to verify if contamination is present.
11. If personnel are found to be contaminated, proceed to the procedures outlined in Section 4.2.3.2.

#### 4.2.3.2 Contaminated Personnel

1. Notify the PHP of any individual with known or suspected contamination.
2. If the contamination is on a personal article of clothing, then perform the following:
   - Survey the inside surface(s) which was against the skin.
   - Verify that no contamination was transferred to the skin.
3. If the contamination is on the skin, then determine if the contamination is in the form of a hot particle.
4. If the contamination is a hot particle, then:

- Quickly evaluate the particle.
  - Particle size
  - Radiation type
  - Visible characteristics
- Attempt to collect and retain the particle for subsequent evaluation.
- Decontaminate the individual in accordance with Section 4.2.4.

5. If the contamination is not a particle, then:
   - Evaluate the contamination levels.
   - Decontaminate the individual in accordance with Section 4.2.4.
6. Complete the applicable parts of the Personnel Contamination Report (Attachment 1).

### 4.2.4 PERSONNEL DECONTAMINATION

> **NOTE**: First aid measures take precedence over decontamination efforts. The RCT shall request support from qualified medical personnel when an injured person requires decontamination.

1. Perform personnel decontamination in a manner that prevents the spread of contamination to other body parts or the ingestion or inhalation of radioactive material.
2. Take appropriate precautions to minimize the spread of contamination when proceeding from the control point or step-off pad to the decontamination area.
3. Personnel will not be released if detectable skin contamination is present unless authorized by the PHP.
4. When performing skin decontamination:
   - Exercise care to avoid damaging the skin.
   - If skin irritation becomes apparent, then discontinue the decontamination and notify the PHP.
   - Record results after each decontamination attempt.
   - Indicate the method of decontamination used.
   - Decontamination of ears, eyes and mouth shall be limited to damp swabs, water or saline solution rinses conducted by the individual. Further decontamination shall be performed under the direction of qualified medical personnel.
   - Decontamination of nasal passages shall be limited to repeated nose blowing by the individual. Supplemental nasal irrigations shall be performed under the direction of qualified medical personnel, as required.

- Use of decontamination processes or materials other than those listed in Table 4-2 will only be performed under the specific direction of qualified medical personnel.
- Immediately report incidents of individual contamination to the PHP.
- Note the final survey results and time of survey.
- Record the area of the skin contaminated in $cm^2$ on Attachment 1.
- For contamination distributed over an area greater than or equal to the area of the probe, the measured activity may be assumed to be distributed over the probe area (area of typical pancake probe is 15.5 $cm^2$).
- If the area of contamination is less than the area of the probe but greater than 1 $cm^2$, the actual area of the activity must be determined.
- If the contamination area is less than or equal to 1 $cm^2$, assume an area of 1 $cm^2$.
- When skin decontamination has been successfully completed, obtain the information needed to complete the Personnel Contamination Report.
- Complete the applicable parts of the Personnel Contamination Report (Attachment 1).

## TABLE 4-2

## PERSONNEL DECONTAMINATION METHODS

| METHOD | EFFECTIVE FOR | INSTRUCTIONS |
|---|---|---|
| Masking Tape | Dry contamination, hot particles | Apply tape to skin by lightly patting. Remove carefully. |
| Waterless Hand Cleaner | All skin contamination | Apply to affected area and allow it to melt onto the skin. Remove with cotton or soft disposable towel. |
| Soap and Tepid Water | All skin contamination except tritium | Wash area with soap and lukewarm water. Repeat until further attempts do not reduce the level. A cloth or surgical hand brush may be used with moderate pressure. |
| Soap and Cool Water | Tritium contamination | Wash area with soap and cool water. Repeat until further attempts do not reduce the level. A cloth may be used with moderate pressure. |
| Carbonated Water | All skin contamination | Apply to affected area with cotton or soft disposable towel and wipe with dry towel. |
| Cornmeal Detergent Paste | All skin contamination | Mix cornmeal and powder detergent in equal parts with enough water to form a paste. Rub onto affected area for 5 minutes. Remove with cotton or disposable towel. Rinse skin. |
| Shampoo | Hair contamination | Wash hair and rinse. Repeat as necessary. |
| Parafilm | All particulate contamination | Apply to affected area of skin. Remove. |
| Sweating | All skin contaminations | Cover affected area with impermeable cover (plastic, glove, Parafilm) to cause sweating. Remove after sweating has occurred and wipe area. |

### 4.2.5 RADIOLOGICAL FOLLOW-UP

The RCT shall:

1. Ensure that the Personnel Contamination Report (Attachment 1) has been completed.
2. Check the location of the contamination event - Contaminated Area, Hot Particle Area, clean area inside a RCA, or clean area outside RCA.
3. Enter any additional information felt to be pertinent.

4. Complete the "Contamination Event Description and Cause" sections of Attachment 1.
5. If the event was directly related to wearing PC, then complete Section A, "Event Directly Related to Wearing PC".
    - Check the appropriate Contamination Event Description.
    - Check the appropriate Basic Cause.
6. If the contamination occurred while removing PC, then complete Section B, "Event Occurred While Removing PC".
    - Check the appropriate "Contaminating Event Description".
    - Check the appropriate "Basic Cause".
7. If the contamination event was not related to wearing PC, then complete Section C, "Event Not Directly Related to Using PC".
    - Check the appropriate "Contaminating Event Description".
    - Check the appropriate "Basic Cause".
8. Review the report with the individual and have them sign and date the form.
9. Sign and date the form.

The PHP shall:

1. Review the Personnel Contamination Report to verify that all required information has been accurately recorded.
2. Complete the "Radiological Task Supervisor" section.
    - Check the appropriate brackets ([ ]) to indicate actions taken.
    - Enter any comments.
3. Sign and date the form.
4. Request support from the qualified medical personnel when:
    - The personnel decontamination methods provided in this procedure are ineffective; or
    - Injured personnel require decontamination.
5. Determine reimbursements and disposition of personal property that cannot be decontaminated.
6. Forward the completed Personnel Contamination Report to the SHSS for review.

The SHSS shall:

1. Review and sign the Personnel Contamination Report.
2. Conduct an investigation into the cause of the contamination.
3. Conduct training on the cause of the contamination and lessons learned and preventive measures.
4. Sign and transmit the Personnel Contamination Report to the PHP for review.

## 5.0 RECORDS

The administrative form included in this procedure (Personnel Contamination Report) shall not be modified without the written authorization of the Project Manager and the documented concurrence of the PHP or designee. In no case shall modifications reduce the content required by the original form.

## 6.0 REFERENCES

| *Number* | *Title* |
|---|---|
| None | |

## 7.0 ATTACHMENTS

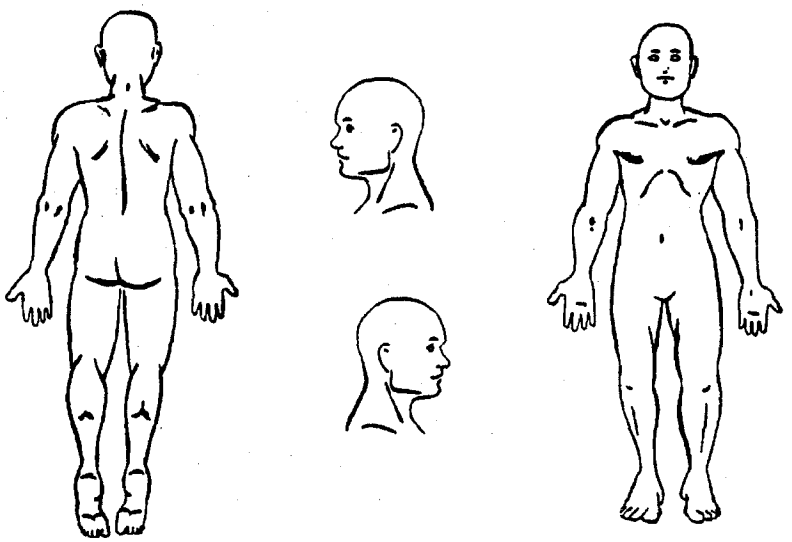
The following form is attached to this procedure:

Attachment 1, Personnel Contamination Report

# ATTACHMENT 1

## PERSONNEL CONTAMINATION REPORT

| Name | | Company | Date | Time |
|---|---|---|---|---|
| EID | Dosimeter# | Dept. | Supervisor | |
| Instrument | | Serial # | Cal. Due Date | |
| Probe | | Serial # | Cal. Due Date | |
| Location of Personnel Contamination | | | RWP #<br>Survey # | |



| Contamination Levels (Use # to reference drawing) | | | | | |
|---|---|---|---|---|---|
| Number | Time | Initial Count Rate | Size of Area ($cm^2$) | Time | Final Count Rate |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| | | |
|---|---|---|
| Decontamination Methods | ___ Wash ___ Number of washes | ___ Other: |
| | ___ Shower ___ Number of showers | |
| Radiological Control Technician Signature: | | Date |
| *I acknowledge the above information represents the contamination event.* | | |
| Individual Signature: | | Date |

Name EID

**CLOTHING CONTAMINATION**

| | | | |
|---|---|---|---|
| Item: | Max cpm | [ ] Decon/Return | [ ] Contaminated/Retained |
| Item: | Max cpm | [ ] Decon/Return | [ ] Contaminated/Retained |
| Item: | Max cpm | [ ] Decon/Return | [ ] Contaminated/Retained |

**RADIOLOGICAL FOLLOW-UP**

| | | | |
|---|---|---|---|
| Location of Event: | [ ] Contamination Area | [ ] Clean area inside RCA | [ ] Clean area outside RCA |
| Follow-up actions: | | | |
| Additional information: | | | |

**CONTAMINATION EVENT DESCRIPTION and CAUSE**

**A - Event Directly Related To Wearing PC**

| Contaminating Event Description | Basic Cause |
|---|---|
| [ ] Contaminated by physical compromise of PC (tear, etc.) | [ ] Improper donning of PC |
| [ ] Contamination penetration of intact PC | [ ] Improper PC use related to worker knowledge/experience |
| [ ] Contamination came from PC | [ ] Work area not deconned to extent practicable |
| [ ] Contaminated skin by touching contaminated item | [ ] Practical limitation of available alternatives |
| [ ] Contamination came from contaminated liquid | [ ] Improper PC requirement on RWP |
| [ ] Contamination came from airborne radioactivity | [ ] Improper control by RCT of worker activity in PC |
| | [ ] Improper laundry/monitoring of PC |

**B - Event Occurred While Removing PC**

| Contaminating Event Description | Basic Cause |
|---|---|
| [ ] Contaminated during removal of hood | [ ] Lack of knowledge in proper methods to remove PC |
| [ ] Contaminated during removal of respiratory equipment | [ ] Lack of knowledge in proper methods to remove respirator |
| [ ] Contaminated during removal of outer PC | [ ] [ ] Worker actions while removing PC - accident |
| [ ] Contaminated during removal of inner PC | [ ] RCT technician actions |
| [ ] Contaminated during removal of plastics | [ ] [ ] Improper monitoring of PC |
| [ ] Contamination came from airborne radioactivity | |

**C - Event Not Directly Related To Using PC**

| Contaminating Event Description | Basic Cause |
|---|---|
| [ ] Contaminated while in area designated as clean RCA | [ ] Noncompliance with postings/rad controls |
| [ ] Contaminated while in area designated clean non - RCA | [ ] Improper monitoring/control of rad material by worker |
| [ ] Contaminated by liquid | [ ] Improper actions at work area (sitting, lying) |
| [ ] Contamination spread to area and not identified | [ ] Accidental contact with contamination beyond worker control |
| [ ] Improper control of airborne radioactive material | [ ] Surveys not appropriate for existing conditions |

**Health Physics Supervisor**

| | |
|---|---|
| [ ] Interview with job coverage RCT | [ ] Released with residual contamination |
| [ ] Exclude individual from further RCA access | [ ] Initiated skin dose calculation |
| [ ] Discussed with individual and supervisor | [ ] No further action required, routine close out |

PHP / /

Print Sign Date

# APPENDIX B

# SAMPLING AND ANALYSIS PLAN

Base Realignment and Closure
Program Management Office West
1230 Columbia Street, Suite 1100
San Diego, California 92101

CONTRACT NO. N68711-98-D-5713
CTO NO. 0087

# APPENDIX B

# FINAL

# SAMPLING AND ANALYSIS PLAN
## (Field Sampling Plan and Quality Assurance Project Plan)
## Revision 0
## September 29, 2005

# INSTALLATION RESTORATION SITE 32
## ALAMEDA POINT
## ALAMEDA, CALIFORNIA

**DCN: FWSD-RAC-05-1808**


TETRA TECH EC, INC.
1230 Columbia Street, Suite 500
San Diego, CA 92101


Mary Schneider — 9/26/05
Mary Schneider, Date
Quality Control Program Manager

Narciso A. Ancog — 9/28/2005
Narciso A. Ancog, Date
NAVFAC SW Quality Assurance Officer

# TABLE OF CONTENTS

# LIST OF FIGURES

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| BEI | Bechtel Environmental, Inc. |
| BRAC | Base Realignment and Closure |
| COC | chain-of-custody |
| CTO | Contract Task Order |
| DOE | Department of Energy |
| DQO | data quality objective |
| EDD | electronic data deliverable |
| EML | Environmental Measurements Laboratory |
| EPA | U.S. Environmental Protection Agency |
| EWI | Environmental Work Instruction |
| IR | Installation Restoration |
| MDA | minimum detectable activity |
| NaI | sodium iodide |
| NAVFAC SW | Naval Facilities Engineering Command, Southwest |
| NFECSW | Southwest Division, Naval Facilities Engineering Command |
| pCi/g | picocuries per gram |
| QC | quality control |
| RASO | Radiological Affairs Support Office |
| RCT | Radiological Control Technician |
| RI | Remedial Investigation |
| ROICC | Resident Officer in Charge of Construction |
| RPM | Remedial Project Manager |
| SAP | Sampling and Analysis Plan |
| $^{90}Sr$ | strontium-90 |
| TtEC | Tetra Tech EC, Inc. |

# 1.0 INTRODUCTION

This abbreviated Sampling and Analysis Plan (SAP) describes sampling and analysis to support Installation Restoration (IR) Site 32 Remedial Investigation (RI) activities being performed by Bechtel Environmental, Inc. (BEI), at Alameda Point, located in Alameda, California. Tetra Tech EC, Inc (TtEC) prepared this SAP on behalf of the Navy, Base Realignment and Closure (BRAC) Program Management Office West under Contract No. N68711-98-D-5713, and Contract Task Order (CTO) No. 0087. The sampling efforts to be conducted under this SAP address minimal sampling in support of the drilling activities conducted by BEI. The SAP will be used in conjunction with BEI's *Final Sampling and Analysis Plan Remedial Investigation, IR Site 32, Northwestern Ordnance Storage Area, Alameda Point, Alameda, California* (BEI's SAP) (2005).

## 1.1 OBJECTIVES

The objective of this project is to perform radiological surveying of the proposed sampling locations, the sampling equipment, and the soil removed during the IR Site 32 RI activities being performed by BEI. IR Site 32 is not considered a radiologically impacted site; however, during the initial work performed by BEI, there was uncertainty if elevated beta activity was encountered. To ensure that proper radiological controls are in place, in the event that radiological contamination is encountered, TtEC has been contracted by the Navy to support BEI IR Site 32 activities and to perform clearance surveys on any equipment for free release if radiological contamination is observed.

In addition to providing radiological surveying support, soil samples from up to 10 locations may be collected and sent to an off-site laboratory for radionuclide identification. Soil samples will be collected at biased locations if radiological contamination if observed to determine the radionuclide(s) of concern. If no radiological contamination is found, then samples for radiological analysis will not be collected.

## 1.2 MAPS

The figure relevant to the proposed drilling locations is Figure 1-6 in BEI's SAP (2005).

# 2.0 PROJECT ORGANIZATION

This section identifies the key individuals from the Navy and TtEC who are responsible for the oversight and/or implementation of the proposed activities. The project organization chart is shown in Figure B.2-1.

## 2.1 POINT OF CONTACT

The following is a list of key contacts for the project:

| Agency | Contact | Project Title |
|---|---|---|
| BRAC Program Management Office West<br>Code 06CHACD<br>1455 Frazee Road, Suite 900<br>San Diego, CA 92108-4310 | Ms. Claudia Domingo<br>(619) 532-0961<br>claudia.domingo@navy.mil | Remedial Project Manager (RPM) |
| BRAC Program Management Office West<br>Code 06CAATM<br>1455 Frazee Road, Suite 900<br>San Diego, CA 92108-4310 | Mr. Thomas Macchiarella<br>(619) 532-0907<br>thomas.macchiarella@navy.mil | BRAC Environmental Coordinator |
| Naval Facilities Engineering Command, Southwest (NAVFAC SW)<br>Caretaker Site Office – San Francisco Bay Area<br>410 Palm Ave., Building 1, Suite 161<br>San Francisco, CA 94130-1806 | Mr. Doug DeLong<br>(415) 743-4713<br>(510) 772-8832 (cellular)<br>douglas.delong@navy.mil | BRAC Environmental Compliance Manager |
| NAVFAC SW<br>1230 Columbia St., Suite 1100<br>San Diego, CA 92101 | Ms. Joyce Howell-Payne<br>(619) 532-0923<br>joyce.howell-payne@navy.mil | Contract Specialist |
| NAVFAC SW<br>Code EVRNA<br>1220 Pacific Coast Highway<br>San Diego, CA 92132 | Mr. Narciso Ancog<br>(619) 532-3046<br>narcisco.ancog@navy.mil | Quality Assurance Officer |
| NAVFAC SW<br>2450 Saratoga Street, Building 110, Suite 200<br>Alameda Point, Alameda, CA 94501-7545 | Mr. Gregory Grace<br>(510) 749-5940<br>gregory.grace@navy.mil | Resident Officer in Charge of Construction (ROICC) |
| NAVFAC SW<br>2450 Saratoga Street, Building 110, Suite 200<br>Alameda Point, Alameda, CA 94501-7545 | Mr. Robert Perricone<br>(510) 749-5942<br>robert.perricone@navy.mil | ROICC Construction Management Technician |
| Radiological Affairs Support Office (RASO)<br>Building 1971<br>NWS P.O. Box Drawer 260<br>Yorktown, VA 23691-0260 | Mr. Matthew Slack<br>(757) 887-4692<br>slackml@raso.navy.mil | RASO |

| Agency | Contact | Project Title |
|---|---|---|
| U.S. Environmental Protection Agency (EPA)<br>75 Hawthorne Street (SFD-8-2)<br>San Francisco, CA 94105-3901 | Ms. Anna-Marie Cook<br>(415) 972-3029 | EPA-RPM |
| TtEC<br>1940 E. Deere Ave, Suite 200<br>Santa Ana, CA 92705 | Mr. Abram Eloskof<br>(949) 756-7521<br>(714) 620-5530 (cellular)<br>aeloskof@tteci.com | Project Manager |
| TtEC<br>1940 E. Deere Ave, Suite 200<br>Santa Ana, CA 92705 | Ms. Mary Schneider<br>(949) 756-7586<br>(714) 620-4551 (cellular)<br>mschneider@tteci.com | Quality Control Program Manager |
| TtEC<br>1230 Columbia St., Suite 500<br>San Diego, CA 92101 | Mr. Roger Margotto<br>(619) 471-3503<br>(714) 810-3742 (pager)<br>rmargotto@tteci.com | Project Environmental Safety Manager (PESM) |
| TtEC<br>3200 George Washington Way, Suite G<br>Richland, WA 99352-3429 | Mr. Cliff Stephan<br>(509) 371-0140<br>(509) 430-4655 (cellular)<br>cstephan@tteci.com | Project Health Physicist (PHP) |
| TtEC<br>1940 E. Deere Ave., Suite 200<br>Santa Ana, CA 92705 | Ms. Lisa Bienkowski<br>(949) 756-7592<br>lbienkowski@tteci.com | Project Chemist |
| Eberline Services, Inc.<br>3200 George Washington Way<br>Richland,WA 99354 | Ahbreza Bleux<br>(509) 551-5582 | Radiological Control Technician (RCT) |

# 3.0 SAMPLING AND ANALYSIS

The following sections described the sampling strategy and analysis requirements for this project.

## 3.1 SAMPLING STRATEGY

Prior to drilling activities, background gamma count rate for the sodium iodide (NaI) detector will be established by TtEC from 10 locations as described in Section 2.1 of the Radiological Support Work Plan (Work Plan). During the drilling activities (as described in Section 3.2 of BEI's SAP), radiological surveying will be performed by TtEC as detailed in Section 2.2 of the Work Plan. At each sample location, The RCT will perform a surface scan to identify any elevated activity before the sampling begins. If radiological contamination is found, a surface soil sample will be collected and a different sample location nearby that does not indicate the presence of radiological contamination will be selected for subsurface sampling. As soil samples for chemical analyses are collected by BEI, TtEC will survey these samples for radiological activity. Subsequently, TtEC will split soil samples with BEI from up to 10 locations that exhibit the highest radioactivity that are 3 sigma above background and send these samples to an off-site laboratory for gamma spectroscopy analysis to identify the radionuclides. Five samples will be selected on a biased basis such that the five samples with the greatest elevated beta/gamma activity or elevated beta activity without associated elevated gamma activity will be analyzed for strontium-90 ($^{90}$Sr). If sample locations do not exhibit radioactivity 3 sigma above background, then samples will not be collected.

## 3.2 ANALYTICAL METHODS

The following analytical methods per the *Gamma Emitting Radionuclides by Gamma Ray Spectrometry, Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA/600/4-80-032) (EPA, 1980) and the Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300* (Department of Energy [DOE], 1997) will be used to analyze samples during this project:

- Gamma spectroscopy by EPA Method 901.1M (modified for solids) or equivalent
- $^{90}$Sr by DOE Sr-01/Sr-02 Method or equivalent

## 3.3 SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

A list of the sample containers, preservatives, and holding time requirements is as follows:

| Analyte | Analytical Method | Container | Preservative | Holding Time |
|---|---|---|---|---|
| Gamma-emitting radionuclides | EPA Method 901.1M or equivalent | 1-liter polyethylene container or acetate liner | None | 6 months |
| $^{90}Sr$ | DOE Sr-01/Sr-02 Method or equivalent | | None | 6 months |

## 3.4 FIELD QUALITY CONTROL SAMPLES

For quality control purposes, field duplicate samples will be collected at a frequency of one for every ten samples and will be analyzed for the same parameters. Field duplicates consist of two distinct samples (an original and a duplicate) of the same matrix collected at the same time and location using the same sampling techniques. Field duplicates are uniquely identified so the identity of the field duplicates is "blind" to the laboratory. Exact locations of field duplicate samples and their identifications will be recorded in the field logbooks. Field duplicates will not be collected for waste characterization samples.

## 3.5 SAMPLING PROCEDURES

Radiological samples will be collected as follows:

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
2. Each sample core that is brought to the surface will be surveyed for radiological activity.
3. Grab samples will be collected with a disposable scoop or equivalent from each core that exhibits radioactivity 3 sigma above background. All containers will be filled completely to ensure adequate sample volume for analysis. If liners are used in conjunction with the drilling activities, then the liner ends will be covered with Teflon® sheets and caps.
4. Samples will be labeled and packaged in accordance with Sections 3.2 and 3.4. Samples will be stored until the drilling activities are completed for this project and then up to 15 samples exhibiting the highest radioactivity will be sent to the off-site laboratory for analysis. Samples will be surveyed before they are removed from the site to ensure that the radiation levels of the sample are acceptable to permit release to the laboratory. This survey will consist of both a dose rate survey using the Eberline MicroRem meter and swipe surveys to ensure that the exterior surfaces of the sample containers are free of contamination.

5. BEI will decontaminate non-disposable equipment in conjunction with their SAP. In addition to this decontamination procedure, TtEC will survey all equipment for radioactivity after it has been decontaminated.

# 4.0 DOCUMENTATION

This section describes the documentation requirements for this project.

## 4.1 SAMPLE NUMBER

Each sample will be identified by an 8-digit number (XX-YYYY-ZZZ) as follows:

XX: 2-character designation of the CTO number (for example, 87)

YYYY: 4-character designation of the site name (for example, IR32)

ZZZ: 3-character designation of the consecutive sample number (for example, 004)

For example, in the sample identification number 87-IR32-004, "87" represents the CTO number, "IR32" represents the site name, and "004" represents the fourth sample collected for the project.

The sample number will be recorded in the field logbook, on the labels, and chain-of-custody (COC) record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

## 4.2 SAMPLE LABELING

Sample labels are necessary to prevent misidentification of samples. Sample labels will be filled out in indelible black or blue ink and affixed to sample containers at the time of sample collection. Each sample label will be covered with clear tape. Each sample container will be labeled with the following, at a minimum:

- Sample identification number
- Sample collection date (month/day/year)
- Time of collection (24-hour clock)
- Sampler's initials
- Analyses required
- Preservative (if any)

## 4.3 FIELD DOCUMENTATION

In order to maintain the integrity and traceability of samples, all information pertinent to field sampling will be recorded in a field logbook. Samples will be properly labeled and custody-

sealed prior to being transported to the laboratory and will be accompanied by completed COC documentation. Associated documentation will be recorded in indelible black or blue ink.

### 4.3.1 Chain-of-custody

To establish the documentation necessary to trace sample possession from the time of collection through analysis, a COC record will be completely filled out during sample collection and will accompany every sample.

### 4.3.2 Custody Seals

Sample custody seals are used to detect unauthorized tampering of samples from the time of sample collection to the time of analysis.

The seals will be signed or initialed and dated by the sampler. The seals will be placed on the sample containers and shipping containers in such a way that they must be broken in order to open the containers. Seals will be affixed to containers before the samples leave the custody of the sampling personnel.

### 4.3.3 Field Logbooks

A permanently bound field logbook with consecutively numbered pages, used for sampling activities only, will be assigned to this project. Entries will be recorded in indelible black or blue ink. At the end of each workday, the logbook pages will be signed by the responsible sampler, and any unused portions of the logbook pages will be crossed out, signed, and dated.

If it is necessary to transfer the logbook to another person, the person relinquishing the logbook will sign and date the last page used, and the person receiving the logbook will sign and date the next page to be used.

At a minimum, the logbook will contain the following information:

- Project name and site location
- Date and time
- Personnel in attendance
- General weather information
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analyses, and sample identification

- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments
- Descriptions of deviations from this SAP
- Problems encountered and corrective action taken
- Identification of field QC samples
- QC activities
- Verbal or written instructions
- Any other events that may affect the samples

### 4.3.4 Document Corrections

Changes or corrections on project documentation will be made by crossing out the erroneous item with a single line and initialing (by the person performing the correction) and dating the correction. The original item, although erroneous, must remain legible beneath the cross-out line. The new information should be entered legibly and in a way to clearly correspond to the crossed-out item.

## 4.4 SAMPLE PACKAGING AND SHIPMENT

Immediately after sample labeling, custody seals will be affixed to each sample container. Each container will be placed in double-resealable plastic bags. Samples will be stored in coolers or equivalent. Ice is not required for radiological samples. Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. The COC record will be completed and signed by the courier. The cooler(s) and the top two copies (white and pink) of the COC record will then be released to the courier for transportation to the laboratory.

# 5.0 QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES

The data quality objectives (DQOs) associated with environmental data are a function of the sampling plan rationale and the procedures used to collect the samples, as well as the analytical methods and instrumentation used. However, uncertainty cannot be eliminated entirely from environmental data.

## 5.1 DATA QUALITY OBJECTIVES

The DQO process is a seven-step planning approach based on scientific methods that are designed to ensure that the type, quantity, and quality of environmental data used for decision-making are appropriate for the intended application. The DQOs are as follows:

### Step 1: State the Problem

Radioactivity was detected during drilling activities performed by BEI at IR Site 32.

### Step 2: Identify the Decision

Are the gamma spectroscopy and $^{90}Sr$ results for the soil samples above background values established during the IR Site 1 and 2 activities?

### Step 3: Identify Inputs to the Decision

- Previous background radiological results from TtEC established during IR Sites 1 and 2 radiological investigations conducted in 2004
- Previous radiological surveying data from BEI in April 2005
- Radiological surveying data collected during this project
- Results from samples sent off site for radionuclide identification

### Step 4: Define the Boundaries

IR Site 32 sampling locations are illustrated in Figure 1-6 of BEI's SAP.

### Step 5: Develop a Decision Rule

If the gamma spectroscopy results are above the background values established by the IR Site 1 and 2 activities or the $^{90}Sr$ results are above background values established by the IR Site 1 and 2 activities, then the Navy and RASO will be contacted to determine the course of action for the site. Otherwise, the results of the soil samples will be documented in the RI Report.

### Step 6: Specify Limits on Decision Errors

To limit decision errors, analytical method requirements and project-specific DQOs have been established. Published analytical methods and laboratory-specific performance requirements are the primary determiners for precision and accuracy.

The field crew will review the SAP before collecting samples. The laboratory performing the analysis will be given the SAP before analysis of the samples.

### Step 7: Optimize the Sampling Design

Soil samples from up to 10 locations exhibiting the highest radiological activity during the drilling activities may be collected for gamma spectroscopy analysis by an off-site laboratory. In addition, five samples will be selected on a biased basis such that the five samples with the greatest elevated beta/gamma activity or elevated beta activity without associated elevated gamma activity will be analyzed for $^{90}Sr$. If sample locations do not exhibit radioactivity 3 sigma above background, then samples will not be collected.

## 5.2 ANALYTICAL DATA QUALITY OBJECTIVES

Analytical data will be obtained using published, standard methods in a state of California Department of Health Services-certified and Naval Facilities Engineering Service Center-evaluated laboratory. The off-site laboratory's standard in-house minimum detectable activities (MDAs) and QC criteria for gamma spectroscopy analysis will be used for this project. The laboratory will ensure that their instrument MDA is capable of detecting environmental levels of naturally occurring radionuclides and fallout level of fission products (e.g., cesium-137, $^{90}Sr$).

## 5.3 DELIVERABLES

The following sections describe the deliverable documents that will be submitted to TtEC by the analytical laboratory.

### 5.3.1 Hard-copy Deliverables

Two copies of the hard-copy data will be submitted to TtEC by the laboratory. The report pages will be sequentially numbered. The report will contain a table of contents referencing individual sections in the data package, original white copy of COC records, a copy of all corrective action reports, and a narrative documenting the resolution of all corrective actions and nonconformances. All TtEC samples will be cross-referenced to the associated QC samples. When revisions to data reports are required, the revised pages will be stamped with the notation "amended or revised report."

For all samples, 80 percent of the data will be submitted in an EPA Level III-equivalent data package and 20 percent in an EPA Level IV-equivalent. All data packages will be assembled in the following sequence:

- Cover page (with laboratory service identification number, TtEC project name, and TtEC project number)
- Original COC records (including cooler temperature and sample condition)
- Sample receipt forms
- Cross-reference table
- Case narrative
- Radiological raw data sequence:
  - Sample result forms, including method blanks
  - Sample raw data after each result form (EPA Level IV only)
  - QC summaries (raw data for EPA Level IV only)
  - Initial calibration
  - Calibration checks, including related continuing calibration verifications
  - Instrument run log
  - Sample preparation log

### 5.3.2 Electronic Deliverables

The electronic data deliverable (EDD) will be in ASCII format. This will be compatible with the Naval Electronic Data Deliverable standard as described in *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (Southwest Division, Naval Facilities Engineering Command [NFECSW], 2005). The laboratory will verify that the EDD and the hard-copy reports are identical. Both the EDD and the hard-copy report will present results to three significant figures. The EDD for each sample delivery group is due at the same time as the hard-copy report, 30 calendar days after the last sample of the sample delivery group has been delivered to the laboratory.

## 5.4 DATA VALIDATION

All sample data will be validated by an independent data validation company. Data will be validated at 80 percent EPA Level III and 20 percent EPA Level IV. The validation will be in accordance with *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation* (NFECSW, 2001) and the QC criteria specified in the referenced methods. Currently, there are no standards for data validation of radiological analyses. Therefore, guidance documents on validation of radiological data and modified functional guidelines will be used by the validator. Data not meeting method and/or SAP specifications will be flagged as estimated ("J") or rejected ("R").

# 6.0 REFERENCES


Bechtel Environmental, Inc. (BEI). 2005. *Final Sampling and Analysis Plan Remedial Investigation, IR Site 32, Northwestern Ordnance Storage Area, Alameda Point, Alameda, California.* CTO-0065/0221. April.

Department of Energy (DOE). 1997. *Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300.* 28th edition. February.

Southwest Division, Naval Facilities Engineering Command (NFECSW). 2001. *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation.* November.

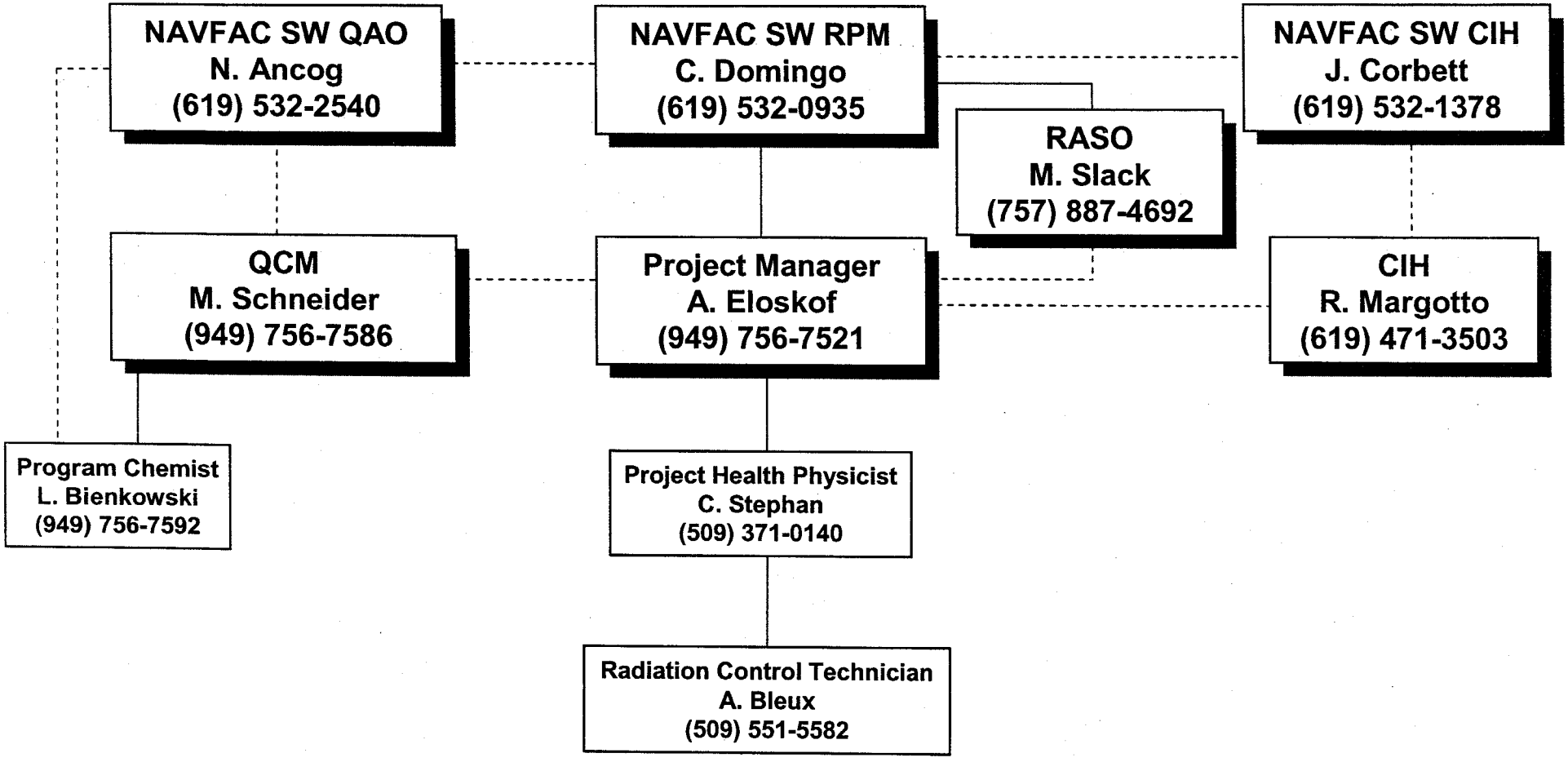
NFECSW. 2005. *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards.* April.

U.S. Environmental Protection Agency (EPA). 1980. *Gamma Emitting Radionuclides by Gamma Ray Spectrometry, Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (EPA/600/4-80-032). August.

# FIGURES

# Figure B.2-1

## Project Organization Chart




Legend

- - - - - - - = In regular contact and coordination

——— = Directly reports to above

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